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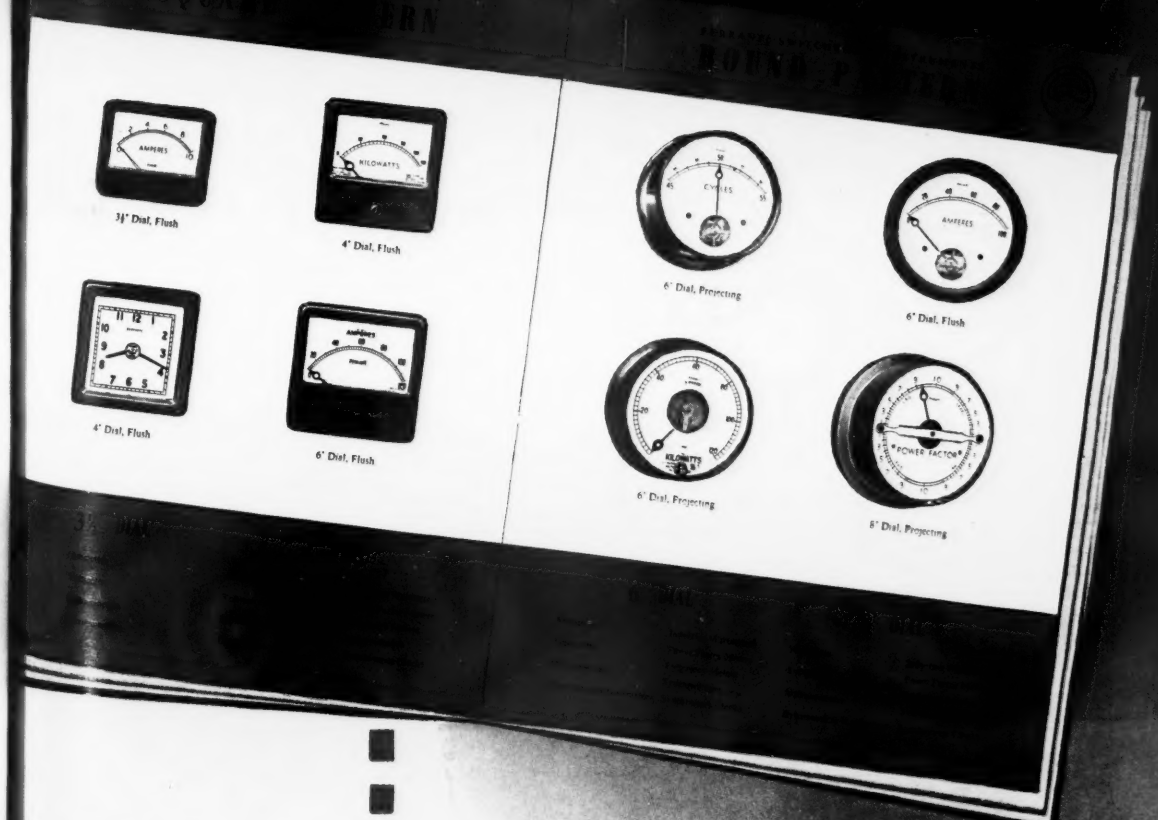

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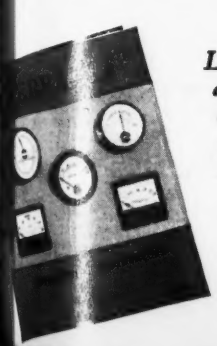

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28 SEPTEMBER 1956

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ELECTRICAL REVIEW

28 September 1956 Vol. 159 No. 13 Established 1872

The Electricity Supply Position

YEAR by year it is almost to be taken for granted that the records of the electricity supply industry will reveal an appreciable advance over the previous twelve months. The Report of the Central Electricity Authority for 1955–56, published this week and reviewed in this issue, lends support to the view that this trend is likely to continue during the foreseeable future, provided the destiny of the industry is left in its own safe keeping. The Report differs from its predecessors in that it no longer covers the South of Scotland. Nevertheless, despite the variation in basis for comparison, it is clear that the advance is being well maintained.

Points that most clearly indicate the improvement on the production side are: growth of load, denoting satisfactory service; increased capacity of new plant, for securing uninterrupted supply in the face of rising demand; effective kW available during peaks as reflecting reliability of new plant and well organised maintenance; higher thermal efficiency of new plant and a higher overall average as a means of saving fuel pending a later gradual transfer of base loads to nuclear power stations. Some compensation for the disappearance of Portobello power station (Edinburgh), which formerly headed the list for high thermal efficiency, is provided by the repetition of the excellent performances of its runners-up and by the promising debut of two new stations which also achieved over 30 per cent and of three only slightly less during an operating period of less than the year.

Thanks to the higher thermal efficiency mentioned above, coupled with a saving in capital costs through technical improvements and a higher output per head of the people employed, the Boards were able to get by with a moderate increase in charges. Only two Boards (South Wales and Yorkshire) incurred deficits and these were small in comparison with the revenue. Whether any further improvements can be big enough to meet the present price " standstill " is somewhat doubtful.

In spite of restrictions on capital expenditure, the extension of supply to rural areas went ahead. Here, apparently, current financial policy is not causing serious delay. That policy has laid a heavy hand on sales of appliances by the Boards which must eventually have its repercussion on electricity sales. It is noteworthy, however, that water heaters were still being bought and it is believed that cooker sales are looking up again.

As a result of the year's operations the combined accounts of the C.E.A. and Area Boards showed a surplus of over £12 million—not an excessive amount on combined revenues amounting to over £380 million.

THE RIGHT PERSPECTIVE

Many of us nowadays are tending to get rather carried away by the great strides which are being made in the field of nuclear power generation and there is a common misconception that the extensive use of nuclear fission in this country will make available an extremely cheap source of electricity. We should get it quite clear in our minds that this is not so, because the distribution of electricity accounts for something like 70 per cent of the price which the consumer has to pay. In the nuclear power station all we are doing is to use uranium, or some other fissile material, instead of coal or oil. This means that even if the fissile material cost nothing the ultimate cost of electricity to the consumer could only be reduced by something in the region of 15 to 20 per cent. Thus nuclear power is unlikely to be a serious competitor with that generated in the conventional manner in those countries having abundant supplies of coal and oil. In this country, however, coal is becoming increasingly scarce and more costly, and the use of nuclear reactors will enable us to generate electricity at a price at least equal to that from conventional oil or coal fired stations.

URANIUM AS A FUEL

At Calder Hall nuclear generating station, which is to be officially opened by H.M. the Queen next month, natural uranium is used as a fuel in the reactors as it will also be in the first stations of the same type to be constructed by the Central Electricity Authority. Natural uranium consists of one part by weight of U235 and 140 parts by weight of U238, and in nuclear reactions involving this material it is usually the U235 atoms that are split. The U235 content of one metric ton of natural uranium is 7,000 grammes and if just under half of this is "fissioned" 3,000 MW-days of energy would be released.

These conditions apply in plants of the Calder Hall type which means that a ton of natural uranium can be made to produce as much heat energy as 10,000 tons of coal of 12,000 B.Th.U./lb calorific value. However, if all the U235 atoms in a ton of natural uranium could be "split" then this would be equivalent to three million tons of coal. It is unlikely that we shall ever achieve this, but figures of 1 ton of natural uranium equivalent to 30,000 or 60,000 tons of coal should be readily achievable in the near future, and a figure of 1 ton of uranium equivalent to a million tons of coal may possibly be obtainable eventually.

"REDUNDANCY"

One of the problems which have arisen as a result of the higher modern standard of employer-employee relations is what to do about men and women who lose their jobs for various reasons such as reduced demand for products, reorganisation or better methods of production. Theoretically in these days of full employment the absorption of displaced workers should be easy but that does not always prove to be the case.

The matter has arisen in the gas industry where because of reorganisation the jobs of some employees of the South Western Gas Board are disappearing. The N.A.L.G.O., to which some of these people belong, suggests that this situation should be met by early consultation before the effects begin to be felt, temporary suspension of recruitment, the transfer of redundant staff to vacant posts (on protected salaries), earlier retirement (without reduction of pension) and the abolition of regular overtime. If dismissals are still inevitable they should be confined to temporary staff who should be given ample notice—six months is suggested.

We draw attention to this because the matter is of general interest and perhaps as likely to occur in the electricity supply industry. It was one of the many subjects considered by the Herbert Committee, which urged the electricity supply industry to "adopt a more flexible and realistic attitude towards redundancy."

BRUSSELS EXHIBITION

Lord Chandos has made an appeal to members of the British Electrical and Allied Manufacturers' Association for financial and material support of the display which the Association is arranging at the 1958 World Exhibition in Brussels. It is important for Great Britain to have a worthy representation at this great international event to show foreign buyers that we are still a great exporting nation able to supply practically any kind of manufactured goods. As the electrical industry is the country's second largest exporting group it must have a representation commensurate with that position and so it is to be hoped that the appeal will be responded to generously and promptly.

It is too often the case that the British element in international exhibitions is negligible in comparison with the displays of other countries. Maybe in the past we could afford to let this happen, relying on the momentum of our reputation, but there have been many changes in the world since the war which make indifference in this respect economically dangerous.

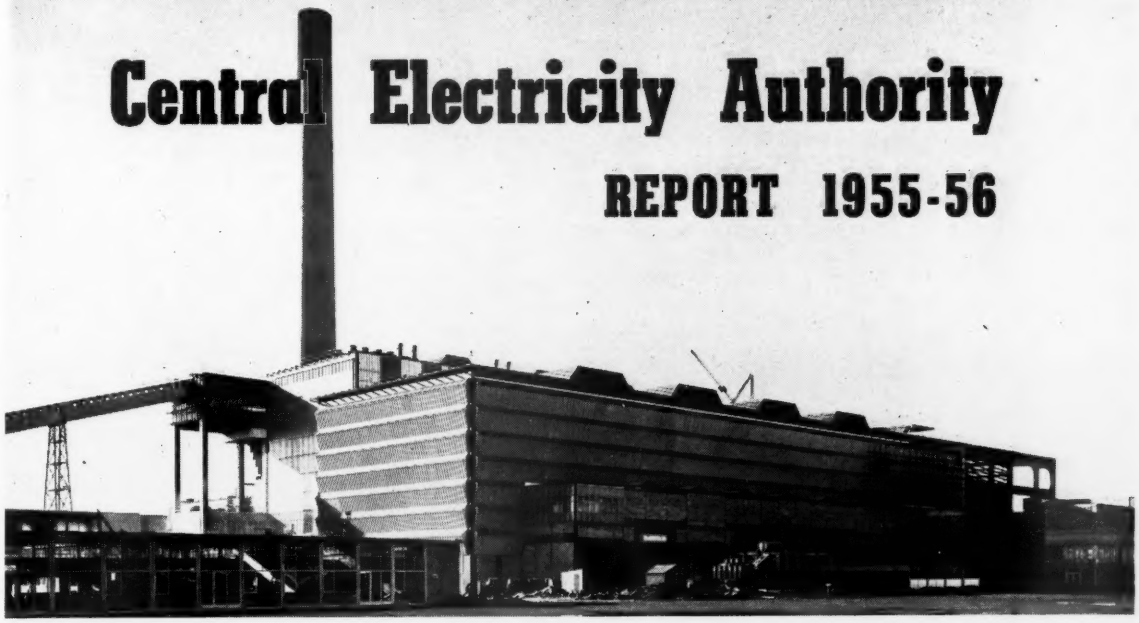
ELECTRIC HEATING

We hope that most electrical people believe that, taking everything into consideration, electric heating is far better than other forms of house warming. At a Press conference last week (see page 579) Mr. Raymond Berry presented a convincing case for electric heating on financial grounds alone, quite apart from its other attributes. He naturally aroused a little scepticism among his audience which, for the most part, had been persuaded by other interests that electric heating was expensive. It can be, of course, if no regard is paid to its different nature or to the circumstances of a particular building. The results are not likely to be economic if electric fires are switched on and left on all over the house all day long.

Full advantage has to be taken of the adaptability and controllability of electric heating and the correct type of appliance must be used in each position. An immense amount of educational work is necessary, for we know from past experience that it is the constant misuse of electric heating which has earned it a reputation for expensiveness. The lay Press (and particularly the women's journals) can do much to correct the situation and it is certainly worth the manufacturers' while to keep them informed so that they can give constant guidance to their readers.

Central Electricity Authority

REPORT 1955-56



THE Report and Statement of Accounts of the Central Electricity Authority, which was published on Tuesday (H.M. Stationery Office, 10s 6d) covers the twelve months ended on 31st March last. At the beginning of the period the establishment of the South of Scotland Electricity Board as a separate administrative body necessitated an alteration in the basis of overall statistics compared with previous years and the name of the British Electricity Authority was changed to that by which it is now known.

Particulars given in Tables 1 and 2 show that, within the present scope of the Authority (i.e. England and Wales), the kWh generated (over 75,000 million) was 9·4 per cent in excess of the figure for the previous twelve months. Steam power stations produced all but 0·3 per cent of the output. Average thermal efficiency of all steam stations, based on kWh sent out (i.e. after allowing 6 per cent for station auxiliaries) reached 24·35 per cent compared with 23·83 in the previous year with a consequent saving of 900,000 tons of coal valued at £3·2 million. Improved thermal efficiency since the pre-vesting year (when it was 20·91 per cent) has up to now saved 23·3 million tons of coal costing £74 million. The average reached by the twenty most efficient stations, which contributed almost 30 per cent of the 70,710 million kWh sent out by steam stations, advanced to 29·01 per cent from 28·53 per cent. The best individual figures were 30·73 by Drakelow, 30·66 by Littlebrook "B," 30·34 by Stourport "B" H.P., and 30·29 by Stourport "B" L.P.

Over 40 million out of the total of 41 million tons of fuel was coal, 5·1 million tons of which were imported. Coal stocks at the start of the period amounted to 3·5 million tons (equivalent to 3·9 weeks of normal winter consumption), reaching 6·6 million (a record figure) early in November, and during the winter falling to 4·5 million by 31st March, 1956. About 20 million tons of coal was transported by rail and 12 million tons by the Authority's fleet of 51 sea-going colliers and by vessels on charter. The pithead price of coal delivered into bunkers (£3 11s 11d) rose by 18 per cent in July, 1955, and the overall average fuel cost increased by 10·9 per cent.

Capacity of new plant commissioned in 1955 (1,632 MW) was the most for any year yet. It was distributed among 37 power stations, seven of which were new. These

Above: Marchwood generating station is unusual in that it is oil-fired and the building exterior is clad with aluminium and glass sheeting

TABLE 1. GENERATION STATISTICS: ALL C.E.A. STATIONS (ENGLAND AND WALES)

Position at 31st March	1956
Power stations in operation, number	274
Installed capacity, MW	20,644
Maximum output capacity, MW (a)	18,845
Electricity generated, million kWh	75,561
Electricity sent out, million kWh	70,894
New power stations commissioned, number	7
Existing stations extended, number	8
Capacity of new plant, MW	1,632
Plant shut down, MW	134
Maximum demand met, MW	16,318
Estimated potential demand, MW	18,500
Plant deficiency, MW	1,700

(a) Installed capacity less that required for station auxiliaries and on account of technical limitations (e.g. restricted feeder capacity).

TABLE 2. STEAM POWER STATIONS (ENGLAND AND WALES) TECHNICAL DETAILS AND COSTS

Position at 31st March	1954-55	1955-56
Technical Details		
Steam power stations, number	224	228
Effective output capacity, MW	17,211	18,698
Electricity generated, million kWh	68,833	75,370
Electricity sent out, million kWh	64,622	70,710
Coal burned, million tons	38·3	40·8
Coal pulverised, per cent	47·44	52·95
Coal, calorific value, B.Th.U. lb.	10,787	10,835
Fuel, lb per kWh sent out	1·328	1·292
Coal cost (excluding handling), d/ton	782	862
Fuel handling, d/ton	42	44
Heat rate, B.Th.U. per kWh sent out	14,321	14,013
Thermal efficiency, sent out, per cent	23·83	24·35
Works Costs		
Fuel, including transport, d/kWh	0·4609	0·4982
Fuel handling, etc., d/kWh*	0·0249	0·0255
Operation salaries and wages, d/kWh	0·0361	0·0373
Oil, water and stores, d/kWh	0·0038	0·0039
Repairs and maintenance, d/kWh	0·0393	0·0396
Total, d/kWh	0·5650	0·6045
Employees (numbers per MW of output capacity)		
Technical and supervisory	0·27	0·26
Operation (workmen)	1·02	0·97
Repairs and maintenance (workmen)	0·77	0·73
Total per MW output	2·06	1·96

* Includes also pulverising, ash handling and disposal, and flue gas treatment.

stations were: Fleetwood, Goldington, Marchwood, Meaford "B," Portishead "B," Stella North and Wakefield "B." Steam conditions at Meaford "B" are 1,550 lb/sq in and 1,060 deg F. Marchwood is oil fired, but it is also equipped to burn pulverised coal. By the end of 1961 over 10,000 MW of new plant is expected to be installed and 1,900 MW of old plant will be closed down.

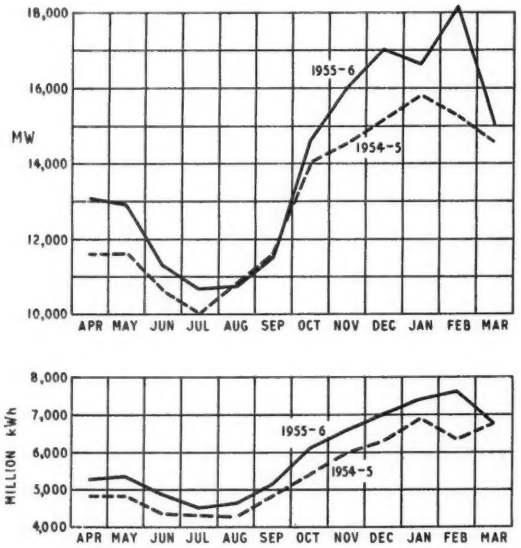
Obsolete plant with an output capacity of 134 MW was shut down, but of the total capacity in operation 19·3 per cent of the generators and 16·1 per cent of the boilers were upwards of 25 years old. An average loss of 8·5 per cent of the system's maximum output capacity was suffered in December and January last year, the lowest on record. This loss was assigned to breakdown 4·1, overhaul 1·6, and miscellaneous 2·8 per cent. The consequent increase in plant availability compared with the average for the past four years was equivalent to 750 MW (sent out).

Competitive designs for the first two complete nuclear power stations of at least 150 MW each are being prepared by four groups of manufacturers to be submitted by 1st October; their construction is planned to start next year at Bradwell (Essex) and Berkeley (Gloucestershire).

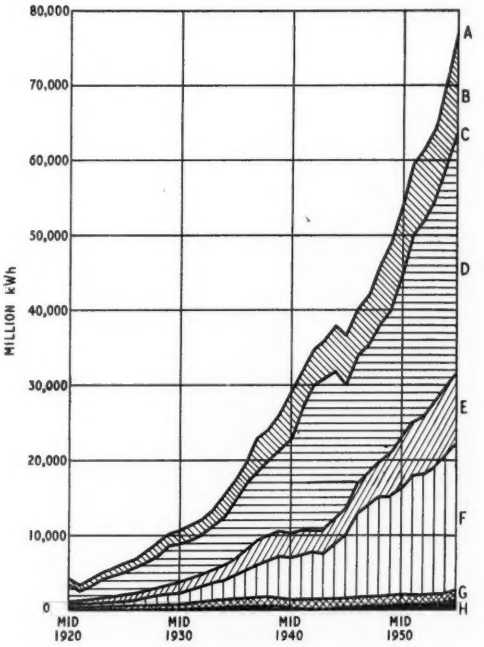
Arrangements have been made to supply fuel oil to 17 stations consuming 5⅔ million tons a year, equivalent to 9 million tons of coal. Underground gasification of coal for 10 MW power stations is not expected to be economic, but might prove to be so for 60 MW stations near the centres of load. The C.E.A. obtained powers during the year to put in hand a 300 MW pumped storage scheme near Blaenau Ffestiniog (the first in Great Britain) and a conventional 49 MW hydro-electric station on the river Rheidol.

Back-pressure plant is to be installed at Spondon power station to supply up to 600,000 klb/hr of process steam to an industrial concern in Derby and a group steam supply scheme has been worked out for Warrington. Regarding domestic supplies of steam from power stations, conditions at Pimlico are not considered typical enough to permit of general conclusions.

The plant programme for 1961, which was approved by the Authority during the year, includes five steam sets of 200 MW, six of 120 MW, one of 100 MW and four of 60 MW and in addition 250 MW (at least) of nuclear plant and 199 MW of pumped storage and conventional hydro-electric plant.



Monthly maximum potential demand (half-hourly) and (bottom) monthly output of C.E.A. power stations including allowance for low frequency, voltage reduction or disconnection of supply



Growth of public electricity supply in England and Wales

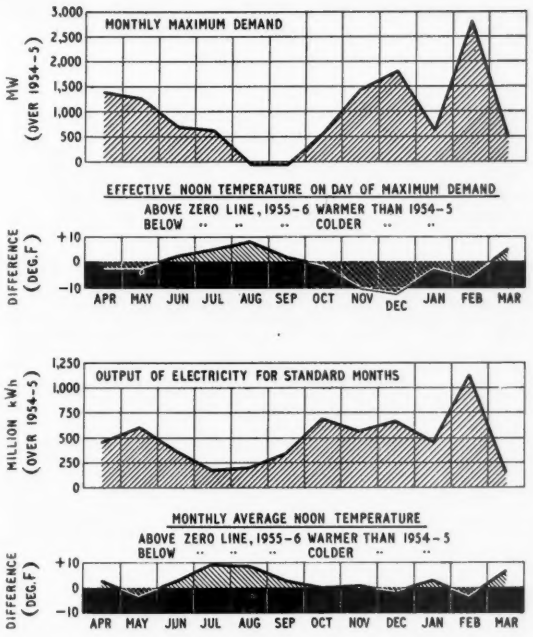
A.—kWh generated. B.—kWh used in power stations and in transmission and distribution. C.—Total kWh sold to consumers. D.—To industry. E.—To commercial premises. F.—Domestic and farm purposes. G.—Sales for traction. H.—Public lighting

In addition to the 200 MW base load sets which have been developed for High Marnham, two further units of that rating are being designed for semi-outdoor stations at West Thurrock (Thames Estuary) and Willington (near Derby), which may be capable of two-shift operation. Natural circulation for the 2,450 lb/sq in boilers seems practicable. Two-shift loading of 120 MW sets is regarded as feasible and thirteen of them are therefore to be substituted in the plans for twenty-six 60 MW sets in five stations. Few further 60 MW machines will be installed. Ferritic steels will be used for pipework for all the 200 MW units.

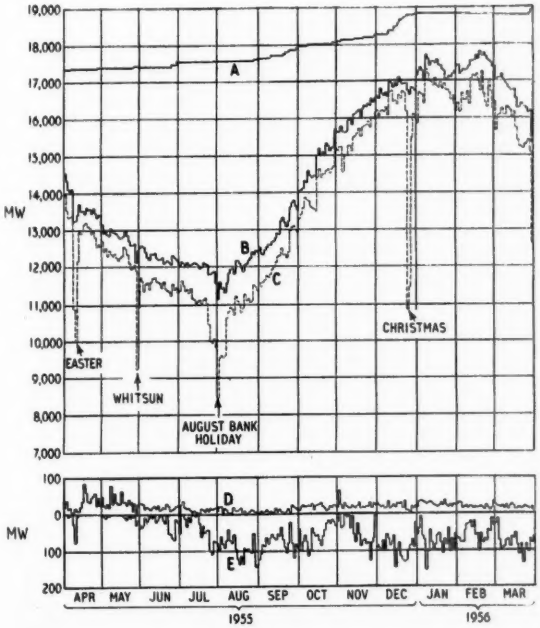
The 1,000 MW High Marnham power station will have only two chimneys up to 400 to 500 ft high, the discharge of hot dry gases in this way being considered to afford the best means of rendering harmless sulphur dioxide effluents.

Particulars of the main transmission systems are given in Table 3. Major works started in 1955-56 included: overhead lines, 406 route miles at 275 kV and 228 route miles at 132 kV; transformers, 2,400 MVA at 275 kV and 2,690 MVA at 132 kV; circuit-breakers, 57 at 275 kV and 102 at 132 kV. The number of substations was increased by twenty, bringing the total at the end of last March to 257.

Substations for 275 kV have been of the double busbar type, but mesh-type installations are planned for six circuit-breakers. Two orders were placed for 132 kV oil-filled cables designed for a maximum stress of 100 kV/cm, the larger consisting of three circuits to transmit 140 MVA (with two circuits loaded) for 3¼ miles. New grid supply points to Area Boards numbered 20, making 128 in all since vesting day with a saving of £12·3 million.



Load and weather differences between 1954-55 and 1955-56. *The monthly maximum demand is the average (whether wholly supplied or not) on C.E.A. stations over the half-hour of highest demand in each month*



Plant capacity and system demand. *A.—Maximum output capacity with all plant in service. B.—Output capacity available after allowing for losses due to breakdown, overhaul and other generating plant limitations. C.—Output capacity as in B less capacity unused because of local circuit limitations within grid control areas. D.—Electricity purchased from South of Scotland Electricity Board and other outside sources. E.—Electricity sold to South of Scotland Board*

During the year 447 faults occurred on the grid system of which 91·3 were correctly cleared. An automatic fault recording scheme, covering the 275 and 132 kV systems is being installed.

The load factor on the grid system over the year, based on the maximum demand supplied was 48·1 per cent, compared with 48·2 per cent in 1954-55, and that based on the maximum potential demand was 44·4 compared with 46·3.

Regarding proposals to give 25 kV single-phase supplies to the railways from the 132 kV system, it is intended to use single-phase transformers banked with existing transformers at grid substations. Studies made of the relative merits of a.c. and d.c. for the proposed cross-Channel connection with France have resulted, as announced since the period of the Report, in preference being given to d.c.

During the period under review temperatures were largely below normal. The maximum demand, 16,703 MW, was experienced on 20th February last; it was 1,333 MW above the 1954-55 figure. The estimated potential demand—18,100 MW on 2nd February—was up by 2,100 MW. The Central Authority's output for the year was 70,894 million kWh and a further 109 million kWh was purchased; the Area Boards purchased 67,145 million kWh and obtained 160 million from private power stations. The Area Boards' sales were 61,450 million kWh; the total sales of the C.E.A. and Boards were 63,265 million kWh. Approvals were given in seven cases for the purchase by Boards of power from other sources.

There was an increase of 9·4 per cent in sales, compared with increases of 11·8 per cent in 1954-55 and 6·9 per cent in 1953-54. Industrial sales rose by 8·8 per cent and domestic sales by 11·0 per cent. The greatest individual increase occurred in the case of the South Western Board (12·7 per cent) and the smallest increase was that of the North Eastern Board (5·9 per cent).

There was a comparatively small increase in sales of energy for railway traction; it is anticipated that the fulfilment of the plan for the modernisation and re-equipment of the railways will add nearly 300 MW to the railways' present demand.

The number of consumers rose by 3·2 per cent to 14,146,585, by far the largest class increase occurring in the case of farms. In the two preceding years the increases were greater.

In 1955-56 the load factor of bulk supplies from the

TABLE 3. MAIN TRANSMISSION SYSTEM

In Commission at 31st March, 1956	
Overhead lines, route miles (total):	4,882·6
275 kV	464·27
132 kV	4,284·89
66 kV and below	133·43
Towers (number)	29,622
Underground cables, route miles (total):	439
275 kV	—
132 kV	68·86
66 kV and below	370·15
Transformer capacity, MVA (total):	24,020
275 kV	840
132 kV	20,977
66 kV and below	2,203

TABLE 4. CONSUMERS AND SALES

Class	No. of Consumers 31.3.56	Per cent inc. on 1954-55	Sales of Electricity 1955-56 Million kWh	Per cent inc. or dec. on 1954-55
Industrial	172,492	1·4	32,431	+ 8·8
Commercial ...	1,137,167	2·2	8,063	+ 9·8
Domestic ...	12,429,943	3·3	18,892	+11·0
Combined domestic and commercial	230,184	0·3	900	+ 8·4
Farm	172,542	9·3	987	+11·7
Traction	65			
Railway		—	1,089	+ 2·7
Street		—	364	− 4·7
Public Lighting ...	4,192	—	539	+ 8·1
Totals	14,146,585	3·2	63,265	+ 9·4

C.E.A. to the Boards ranged from 39·1 per cent in the case of the London Board to 60·4 per cent for the South Wales Board and the effective running charge from 0·5294d (Yorkshire) to 0·7148d (Eastern).

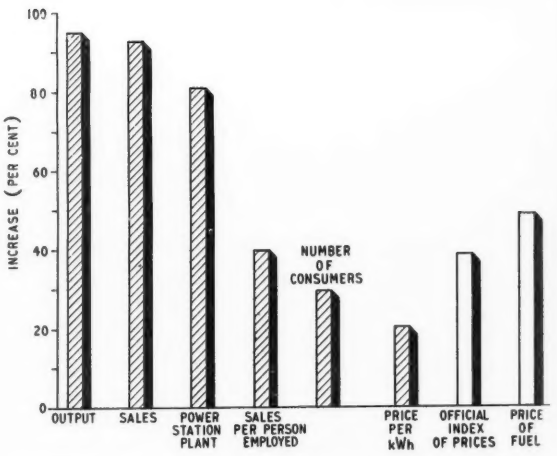
All the Area Boards have now published standard domestic tariffs and the Yorkshire Board has introduced a standard tariff for farm consumers with demands up to 50 kVA. Reductions were made by the Boards in coal-variation rate adjustments during the year. Price increases to consumers whose agreements do not include a coal-variation clause were made during the year. The Retail Tariffs Committee is reviewing its original recommendations to the Area Boards in the light of comments by the Herbert Committee.

A record number of farms (14,666) were connected during the year; the average annual consumption per farm rose to 5,722, or by 1·4 per cent over the 1954-55 figure—a much smaller increase than in preceding years. It is estimated that 63 per cent of farms and 80 per cent of other rural premises have now been connected. Rural extensions will be handicapped by credit restrictions, but as the programme is ahead of schedule it is expected that the target figure for March, 1958, will be reached.

Pressure on financial and material resources has also slowed down the rate of conversion of non-standard supplies but 97 per cent of all consumers are now connected to the a.c. system. On the other hand there has been an increase in the number of consumers on non-standard a.c. supplies.

Through the British Standards Institution and the British Electrical Development Association the Authority and Boards have continued to take an active part in the standardisation of appliances and accessories. Reference is made *inter alia* to the preparation of new or revised specifications for "ready-to-fit" thermal insulating materials, polyphase kilowatt m.d. meters, cord-operated ceiling switches, electrically-heated blankets, etc. A draft specification for pre-stressed concrete street-lighting columns was examined, with particular regard to the possible use of pulverised fuel ash in the concrete mix. Off-peak electric heating methods, including floor-warming, are being more widely adopted. Close attention is being given to the development of appliances for off-peak use or with other favourable load characteristics; to the control of industrial machinery; and to applications of electro-heating in industry.

The control room at Keadby is circular and in a separate building from the station itself



Increases in output, sales, prices, etc., since 1947–48 (pre-vesting)

Interim arrangements for dealing with employees' inventions have been revised; mention is made of patent specifications filed during the year.

The report refers to the National Inspection Council for Electrical Installation Contracting (now in being) and to the Joint Technical Committee of the Electricity Boards and the Electrical Contractors' Association, and the regional liaison committees, which have continued to consider problems of common interest. Part I of the new edition of the I.E.E. Wiring Regulations has been accepted by the C.E.A. and Boards as providing a minimum code of wiring practice.

Sales of Appliances

Contracting and fittings sales activities by the Boards have been restricted by higher purchase tax on appliances and more onerous hire-purchase terms. But while sales of cookers, washboilers and washing machines were adversely affected, sales of water heating appliances were sustained. The Boards agreed that no new appliances should be let on hire during the period of financial stringency and that promotional advertising in the national Press should be temporarily suspended.

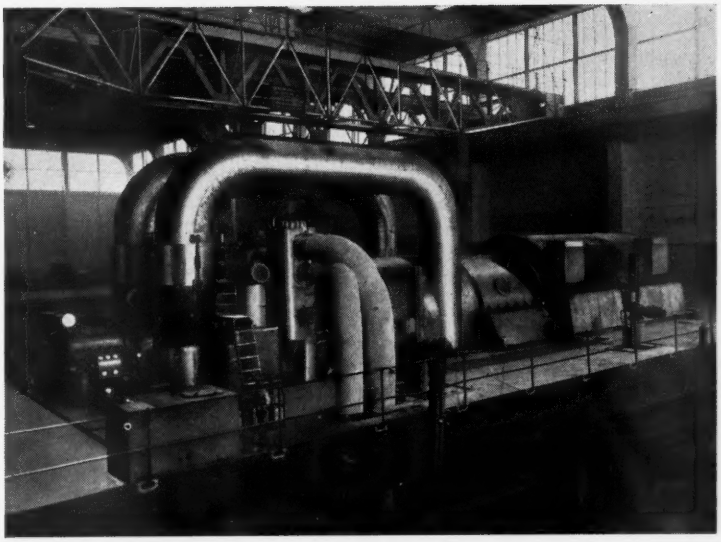
On the subject of the commercial use of pulverised fuel ash the report says that progress was made on the sintering plant at Battersea power station (to be run by a building contracting company) for the conversion of some 65,000 tons a year into a lightweight aggregate and it is expected to be in commercial production before the end of this year. Proposals for similar works at several other power stations are under consideration.

Utilisation research was continued during the year. Preliminary results have been published of the data obtained from a sample of about 12,000 consumers. The six experimental houses with high thermal insulation, off-peak floor heating and dual-purpose heat pumps were completed last autumn. The installations appeared to be satisfactory but

experience was too short to reach conclusive results on the economics of the scheme. Further consumer-analysis schemes were undertaken.

At the close of the year the Central Authority was employing 50,702 people and the Area Boards 130,221—a total of 180,923 of whom 11·7 per cent were women. Manual workers (115,558), representing 64·1 per cent of the total, showed an increase of 0·3 per cent. There was a decrease of 0·3 per cent in the managerial and higher executive class (1,335). Technical engineering staff (15,480) rose by 3·0 per cent and executive, clerical, accountancy, sales, etc., staff (40,636) by 1·6 per cent. The largest increase (4·3 per cent) was in the number of technical trainees and apprentices (7,538).

While the increase in the total number of employees was only 0·98 per cent, the output capacity of the power stations went up by 8·6 per cent, the number of consumers by 3·2 per cent and the sales of electricity by 9·4 per cent.



The four 60 MW turbo-alternators at Meaford "B" incorporate two-cylinder turbines of novel design

Some details are given of negotiations on wages and conditions during the year and the subject of joint consultation receives brief consideration, as do safety, health and welfare, and education and training. Reference is made to the further training arrangements made with the Atomic Energy Authority in connection with the Central Authority's programme of nuclear power stations.

Financial Results

The consolidated surplus of the Authority and Area Boards was £12,212,242 (against £18·79 million in 1954-55, including the two Scottish Boards). To this figure was added £9,441,000 from taxation reserves while £11,700,000 was transferred to supplementary reserves for depreciation of fixed assets, leaving a net amount of £9,953,242 available for general reserves. Of this £3,000,000 is put to the central reserve fund and £3,050,000 to Area reserve funds, leaving £3,903,242 to be added to balances brought forward. Present balances are: Central reserve fund £14 million; Area reserve funds £13·15 million; and carried forward £12·87 million.

The main item (97·23 per cent) in the combined revenues

TABLE 5. ANALYSIS OF ELECTRICITY BOARDS' SALES

Board	Population at 30.6.55 (Thous.)	No. of consumers (Thous.)	Sales of Electricity (Thousands of kWh)							
			Domestic	Farm	Commercial	Industrial	Public Lighting	Traction	Total (excl. inter-Board sales)	Inc. over 1954-55 Per cent
London	5,042	1,716	2,394,055	485	1,804,186	1,621,801	104,791	79,448	6,004,766	9·7
S. Eastern	3,325	1,128	1,873,947	65,730	611,712	1,112,590	40,318	18,422	3,722,719	11·7
Southern	3,888	1,220	1,789,090	141,487	799,182	1,637,575	35,056	20,063	4,530,576*	11·5
S. Western	2,143	696	929,068	75,120	480,836	842,479	21,815	—	2,349,318	12·7
Eastern	4,961	1,597	2,531,293	134,504	797,742	2,293,398	51,371	126,009	6,076,745*	10·2
E. Midlands	3,741	1,206	1,507,707	129,832	453,228	2,979,343	40,404	20,371	5,236,118*	9·4
Midlands	4,177	1,304	1,835,453	117,489	593,129	4,228,375	43,122	18,737	6,974,955*	7·3
S. Wales	1,996	577	598,863	27,433	296,672	3,208,140	23,081	9,684	4,163,873	8·8
Merseyside and N. Wales ...	2,869	841	1,071,439	71,863	526,294	2,315,978	33,068	66,004	4,150,785*	10·2
Yorkshire	4,204	1,405	1,574,402	66,826	549,039	4,466,487	49,612	106,116	6,970,435*	9·0
N. Eastern	3,005	921	880,854	47,338	419,651	2,487,923	29,646	57,771	3,923,183	5·9
N. Western	4,565	1,536	1,905,805	109,263	912,992	4,315,710	66,636	35,823	7,346,229	6·0
Totals	43,916	14,147	18,891,976	987,370	8,244,663	31,509,799	538,920	558,448	61,449,702	9·0

* Including combined domestic and commercial supplies as follows (thous. kWh):—Southern, 108,123; Eastern, 142,428; East Midlands, 105,233; Midlands, 138,650; Merseyside and N. Wales, 66,139; Yorkshire, 157,953.

TABLE 6. ELECTRICAL CONTRACTING AND SALES OF FITTINGS

Board	Sales		Direct Costs				Indirect Costs		Surplus			
	1954-55	1955-56	1954-55	Per cent*	1955-56	Per cent*	1954-55	1955-56	1954-55	Per cent*	1955-56	Per cent*
	£	£	£		£		£	£	£		£	
London	3,803,588	4,325,897	3,067,764	80·7	3,543,835	81·9	552,557	594,142	183,267	4·8	187,920	4·4
S. Eastern	3,265,868	3,754,809	2,513,765	77·0	2,891,810	77·0	474,876	558,713	277,227	8·5	304,286	8·1
Southern	4,042,997	4,403,273	3,192,623	79·0	3,471,145	78·8	653,426	732,705	196,948	4·9	199,423	4·5
S. Western	2,460,554	2,837,408	1,935,555	78·7	2,213,153	78·0	474,183	544,507	50,816	2·0	79,748	2·8
Eastern	7,029,542	7,192,895	5,628,137	80·1	5,811,547	80·8	1,110,480	1,183,620	290,925	4·1	197,728	2·7
East Midlands	2,255,259	2,018,080	1,817,551	80·6	1,633,129	80·9	307,967	313,372	129,741	5·7	71,579	3·6
Midlands	6,374,835	6,185,750	5,084,961	79·8	4,913,996	79·4	991,350	1,133,449	298,524	4·7	138,305	2·2
S. Wales	1,724,816	1,709,088	1,368,021	79·3	1,349,726	79·0	287,768	318,353	69,027	4·0	41,009	2·4
Merseyside and N. Wales ...	2,143,425	2,266,213	1,763,299	82·3	1,883,173	83·1	274,336	313,887	105,790	4·9	69,153	3·1
Yorkshire	4,317,395	3,512,868	3,521,038	81·6	2,822,285	80·3	489,405	484,113	306,952	7·1	206,470	5·9
N. Eastern	2,133,786	1,660,729	1,730,599	81·1	1,347,917	81·2	156,250	194,213	246,937	11·6	118,599	7·1
N. Western	5,043,148	4,634,168	4,082,564	81·0	3,752,295	81·0	662,324	669,558	298,260	5·9	212,315	4·6
Totals	44,595,213	44,501,178	35,705,877	80·0	35,634,011	80·1	6,434,922	7,040,632	2,454,414	5·5	1,826,535	4·1

* On total sales.

TABLE 7. AREA BOARDS' REVENUE AND EXPENDITURE

Board	Total Income		Total Expenditure		Surplus or Deficit		Revenue per kWh sold (pence)*	
	1954-55	1955-56	1954-55	1955-56	1954-55	1955-56	1954-55	1955-56
	£	£	£	£	£	£		
London	42,029,550	45,969,269	41,172,271	44,910,217	857,279	1,059,052	1·781	1·778
South Eastern	23,457,245	26,177,965	22,748,190	25,749,600	709,055	428,365	1·576	1·574
Southern	27,903,770	31,300,711	27,030,838	30,525,533	872,932	775,178	1·590	1·601
South Western	14,638,318	16,660,143	14,201,274	16,154,117	437,044	506,026	1·642	1·655
Eastern	35,923,494	41,386,952	35,865,528	40,331,364	57,966	1,055,588	1·519	1·593
East Midlands	26,710,548	29,847,084	26,184,615	29,539,170	525,933	307,914	1·299	1·329
Midlands	35,330,282	39,460,920	34,896,322	38,793,011	1,433,960	667,909	1·305	1·327
South Wales	17,304,580	19,725,789	17,483,772	19,886,077	−179,192	−160,288	1·066	1·120
Merseyside and N. Wales	20,979,577	23,495,934	20,354,734	23,355,200	624,843	140,734	1·306	1·331
Yorkshire	31,023,286	35,359,167	30,829,115	35,336,900	194,171	−77,733	1·127	1·181
North Eastern	20,356,399	22,591,018	19,863,619	22,224,898	492,780	366,120	1·279	1·344
North Western	38,630,222	41,858,083	37,727,790	41,638,742	902,432	219,341	1·303	1·332
Totals	334,196,776	372,429,861	327,267,573	367,141,655	6,929,203	5,288,206	1·380	1·416

* Excluding inter-Board sales.

of £308·46 million was sales of electricity £369·94 million. Of the combined expenditures of £368·25 million generation costs and purchase of electricity accounted for £182·17 million (47·88 per cent), depreciation of fixed assets £56·26 million (14·79 per cent), interest £39·92 million (10·49 per cent), and distribution costs £26·02 million (6·84 per cent). Main transmission costs amounted to only £2·23 million (0·59 per cent).

In spite of substantially increased costs for coal, transport, wages and salaries and interest, necessitating higher charges, the revenue per kWh sold rose by only 0·031d/kWh; industrial supplies, due no doubt to the operation of coal clauses, sustained the biggest increase (0·048d/kWh) while the cost of domestic supplies increased by only 0·006d/kWh. The effects of rising costs were offset by greater efficiency of generation, the greater productivity per head of the people employed and technical improvements which led to substantial savings in capital costs. The actual fuel cost per kWh sold advanced from 0·511d to 0·558d.

Capital expenditure by the Central Authority during the year amounted to £137·07 million and that of the Boards to £76·26 million—a total of £213·33 million. The corresponding expenditure during 1954-55 was £188·80 million. After meeting depreciation and other capital provisions the net addition to fixed assets was £149·59 million, raising the gross book value of fixed assets at 31st March last to £1,884·75 million—an increase of 12·2 per cent. About 83 per cent of the Authority's capital expenditure related to power station construction and 16 per cent to the development of the main transmission system. The working capital of the C.E.A. and Boards at 31st March was £62·30 million.

Under the settlement with the South of Scotland Board an amount of £58,528,000 is to be treated as a loan by the Authority to the Board. The average rate of interest for 1955-56 was 3·48 per cent and the Board repaid an amount of £650,000, equivalent to its share of the Authority's stock redemption fund contribution.

It will be seen from Table 7 that the aggregate revenue of the twelve Area Boards was £372·43 million and their expenditure £367·14 million, leaving a surplus before transfers to reserves of £5·29 million. To this is added transfers from taxation reserves £3·29 million and from the total is deducted £1·70 million as transfer to supplementary reserves for depreciation of fixed assets. Thus the net surplus available for general reserves is £6·88 million; the central reserve receives nothing this time, the Area reserves receive £3·05 million. To the surplus is added £6·71 million brought forward raising the amount carried forward to £10·54 million.

TABLE 8. AVERAGE PRICE PER KWH SOLD (PENCE)

Class	1954-55	1955-56
Industrial	1·151	1·194
Commercial	1·905	1·931
Domestic	1·518	1·533
Combined domestic and commercial	1·728	1·735
Farm	1·472	1·496
Traction	1·108	1·152
Public lighting	1·392	1·448
Totals	1·370	1·403

Lord Citrine's Comments

At a Press conference held on Tuesday Lord Citrine commented on a few matters of outstanding importance arising from the report and of current topical interest. He said that last year the average revenue received from all electricity sold was 1·403d/kWh, an increase of less than one-third on the pre-war price. The Authority had accepted the view of the Herbert Committee that prices should be increased in order, among other things, to enable the C.E.A. to finance future construction programmes out of revenue to a larger extent than hitherto, but it had not been able to give effect to this raising of prices at a period when the Government was endeavouring to keep them down and the Electricity Boards had been asked not to increase their tariffs. Although some would incur deficits there would be no deficit for the industry as a whole in the current year.

Lord Citrine denied that the Authority was " autocratic " in choosing sites for transmission line towers. For the siting of each tower the consent of the owner of the land or authorisation by the Minister must be obtained and care was taken to avoid damage to amenities. After outlining the plans for nuclear power stations, he referred to the effect of cuts in capital expenditure, saying that there had been no undue curtailment of development of rural supply and none was contemplated.

Minister's Report

Appointments during 1955-56 to the Central Authority and Boards are dealt with in the report by the Minister of Fuel and Power for the period. The report also refers to " the national policy of restraint on capital investment," stating that the Minister approved the Authority's and Boards' plans for capital expenditure in 1956-57 at an estimated cost of £195 million. He informed the Authority that no new finance would be available for hire-purchase purposes for that year.

The approvals previously given for generating plant commissioning rates rising to an annual rate of 1,950 MW (sent out) in 1959 and 1960 have not been modified. After the end of the period under review, approval was given for a plant commissioning rate of 2,250 MW (s.o.) in 1961, or 250 MW less than the Authority proposed. The figures include the South of Scotland.

The C.E.A. informed the Minister that the reduction

in the capital investment programme would necessitate the deferment of the Rheidol and Ffestiniog hydro-electric schemes and construction work or installation of plant in certain cases in the steam station programme. Work on nuclear power stations and the conversion of stations to dual firing would not be affected. It would also be necessary to reduce by about one-tenth the Area Boards' expenditure on distribution projects but this was not expected to interfere with the rural electrification programme.

Approval was given to the C.E.A.'s research and development programme and, following a recommendation by the Minister's Scientific Advisory Council, the Authority stated that it was already taking steps to publish the results of its research.

A report on education and training programmes was submitted by the Authority and the Minister has asked for separate sections on the Area Boards' programmes to be included in future reports. References are made to the superannuation scheme for manual employees, to the Herbert Committee's report and to the Consultative Councils.

On 11th August, 1955, the Minister gave consent to the issue of £200 million of 4½ per cent guaranteed stock. Particulars are given of Treasury approval of temporary borrowings by the Authority and a number of other routine matters are dealt with.

Consents were given to the construction of new power stations at Rugeley, High Marnham, Aberthaw and Northfleet with an aggregate of 2,560 MW and to extensions at Agecroft " B," Hayle, Little Barford " B," Poole and Staythorpe " B " stations. There is a reference in the report to the approval given for the erection of the first two nuclear power stations (Bradwell, Essex, and Berkeley, Gloucestershire) of the twelve projected by the C.E.A.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Faster Boiling Plates

MAY I draw your attention to several serious misstatements which occur in the article appearing on page 458 of the *Electrical Review* dated 14th September and headed " Faster Boiling Plates." The errors are as follows: —

Boiling time for 1 pint of water from cold.

	Quoted	Fact
Gas	4½ min	2·6 min
Electricity (using standard 1,800 W 8in radiant plate)	6 min	4·2 min

The time claimed for the new device referred to in your article to boil one pint from cold is 3½ to 3¾ minutes, which gives a decrease over the existing standard radiant plate of approximately ½ minute, but which still lags considerably behind the time taken by gas.

Perhaps you would be good enough to print this information so that any wrong impressions created by the article may be dispelled.

London, W.C.2.

T. COUNTER,
Secretary, D.E.A. Section,
British Electrical and Allied Manufacturers' Association.

Technical Qualifications

I WOULD not disagree with the first paragraph of the letter by " Forfor " in your issue of 14th September, but I think the whole force of his argument is likely to be disregarded because of the light-hearted way in which he dismisses the difference between the technically unqualified and the chartered engineer.

The difference is not just a " piece of paper " as he suggests, but is normally a long and highly organised training during the most receptive period of the man's life. Amongst many other things, it constitutes a proof of success in forms of scientific thinking, in some applications of science, and in the acquisition of engineering knowledge of a high order of complexity. In the instances cited, managerial capacity may or may not have been developed, but the technically qualified can be expected to occupy a position of some advantage in learning the art of management especially as applied to his own industry. However, like any art, a certain germ of it must be inborn or inbred and it can flourish only by diligent application.

Broadly speaking, engineering is the economic application of technology and some of the art of engineering is common to the art of management. I therefore suggest that the successful manager who is also a chartered engineer is likely to be a better manager than one who is technically unqualified.

" M.I.E.E."

Basic Lighting Terms

I SHOULD like to refer to two matters in the article by Mr. Harrison-Jones published under the above title in your issue dated 21st September. The first, although the smaller, is not without importance. The now internationally agreed abbreviation for lumen is lm and not l which, incidentally, is awkward both when typewritten and when printed. The compound abbreviations are, of course, lm/ft², lm/W, etc.

The second matter is more fundamental and relates to the units of brightness or, more precisely, luminance. In the eighth paragraph of his article Mr. Harrison-Jones seems to imply that there is something not quite exact about the foot-lambert. In fact this unit is just as precisely defined as the candela per unit area. It is the luminance of a uniformly diffusing surface with a reflection factor of 100 per cent when its illumination is one lumen per square foot.

The luminance of *any* surface whatever, in a given direction, can be expressed exactly in terms of this unit. The imprecision occurs when an ordinary unpolished surface is assimilated to a uniform diffuser and the value of luminance is taken as equal to the product of the illumination in lm/ft² and the reflection factor. This is only strictly true for the uniform diffuser; for other surfaces (except quite fortuitously) the luminance in a given direction will differ to a greater or less extent from this product.

The departure may, of course, be enormous under certain conditions. For example, in street lighting the luminance of a particular patch of road surface may be 10 or even 100 times the product of the illumination and the reflection factor; it can, nevertheless, still be precisely expressed in foot-lamberts.

Teddington, Middx. J. W. T. WALSH.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Sir Edwin Plowden, chairman of the United Kingdom Atomic Energy Authority, and **Sir John Cockcroft,** director of the Atomic Energy Research Establishment at Harwell, left for America last week-end to attend a meeting on the economic aspects of nuclear energy which is being held as part of this year's meeting of the International Bank. **Admiral Strauss,** chairman of the United States Atomic Energy Commission will also take part. Sir Edwin Plowden will speak on the British nuclear power programme and Sir John Cockcroft on the possible developments of nuclear power within the next ten years.

Mr. R. M. Fairfield, director, and **Mr. H. Gittens,** chief superintendent of British Insulated Callender's Cables, Ltd., left by the Canadian Pacific Airlines Polar route from Amsterdam on 20th September to attend the opening ceremony of the Vancouver submarine power cable installation at Victoria, Vancouver Island, B.C., which took place on Tuesday last (see page 570). **Mr. W. H. McFadzean** (chairman) and **Mr. C. O. Boyse** (director), who left on 22nd September, also attended the opening ceremony.

The British Transport Commission announces that **Mr. G. B. R. Feilden,** engineering director of Ruston & Hornsby, Ltd., Lincoln, has accepted its invitation to become a member of the Commission's Research Advisory Council.

Mr. D. B. Irving, B.Sc., M.I.E.E., chairman of the London Electricity Board, will be the speaker at the opening meeting of the 1956-57 session of the Southern Meter Engineers' Technical Group of the Electrical Power Engineers' Association, to be held at Caxton Hall, Westminster, S.W.1, on 12th October (6.30 p.m.). Mr. Irving will describe his visit to Russia as a member of the British delegation, which followed the visit to this country earlier this year of the Russian team led by Mr. Malenkov.

At the recent annual general meeting of the **British Internal Combustion Engine Research Association** Viscount Falmouth was re-elected president. Sir Harold Roxbee Cox, Dr. S. F. Dorey, chief engineer surveyor, Lloyd's Register of Shipping, Brigadier H. P. Drayson, director, Royal Engineer Equipment, Ministry of Supply, and Vice-Admiral Sir Frank Mason, engineer-in-chief of the Fleet, were re-elected vice-presidents. Professor O. A. Saunders, professor of mechanical engineering, City and Guilds College, has accepted an invitation to become a vice-president. Mr. H. N. G. Allen and Mr. L. W. Robson were elected to the Council, and Mr. G. W. Bone has been elected chairman of the Council.

Mr. Charles W. Hodgson, A.M.I.Mech.E., has resigned from the position of generation engineer (construction) with the East Midlands Division of the Central Electricity Authority to take up the position of chief engineer, thermal power plants, with Ewbank & Partners (Canada), Ltd., in Toronto, Ontario. Mr. Hodgson received his engineering training with the North Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne, and his technical education at Rutherford Technical College, Newcastle-upon-Tyne. Before joining the Central Electricity Authority he was with Merz & McLellan, consulting engineers, Newcastle-upon-Tyne. During the last war he served in the Royal Navy as an engineer officer with the rank of lieutenant (E). Mr. Hodgson is at present at the Grosvenor Place office of the parent company until leaving with his family for Canada by the s.s. *Empress of Scotland* on 19th October.

Mr. C. W. Hodgson

The article on page 565 entitled "Automatic Circuit Reclosers on Rural H.V. Lines" is by two members of the Midlands Electricity Board staff. **Mr. R. Mallet,** B.A., M.I.E.E., has been manager of the Worcester and District Sub-Area since 1951 and **Mr. N. C. Heathcock,** B.Sc., A.M.I.E.E., has been senior assistant engineer of the same Sub-Area since 1953.

Mr. Mallet was an Exhibitioner at Trinity Hall, Cambridge, in the mechanical sciences tripos. After training at the British Thomson-Houston Co., Ltd., he spent three years with the West Cambrian Power Co. as assistant engineer, followed by five years as mains engineer with the Buckrose Light & Power Co. Mr. Mallet became district manager at Redditch with the S.W. & S. Power Co. in 1945, followed by a few months in 1948 as section head, Planning and Development Section, Midlands Electricity Board. In 1949 he visited the United States as a member of the British Electricity Authority's productivity team, and before taking up his present position was deputy chief engineer of the Midlands Electricity Board.

Mr. R. Mallet

Mr. N. C. Heathcock

Mr. Heathcock received his technical education at the University of Birmingham and after three years in the Royal Naval Volunteer Reserve he joined the Midland Electric Corporation, Ltd., in 1946 as junior engineer. In 1947 he became district engineer first at Old Hill, and then in 1948 at Stourbridge with the Midlands Electricity Board. In 1950 he was appointed assistant engineer (technical) in the Chief Engineer's Department, and a year later assistant engineer (planning and operations) in the Worcester and District Sub-Area.

Mr. Airey Neave, D.S.O., O.B.E., M.C., M.P., has joined John Thompson, Ltd., Wolverhampton, as their legal adviser. Mr. Neave has recently relinquished his appointment as Parliamentary Private Secretary to Mr. Lennox-Boyd, Colonial Secretary.

Mr. A. J. Murray, hon. social secretary of the Electrical Trades' Commercial Travellers' Association, was married on 15th September at Caxton Hall, London, S.W.1. The reception was held at the Victoria, Grosvenor Gardens, S.W., and among those who attended were Mr. L. A. Fickling and Mr. H. Bowen (past chairmen of the Association), Mr. E. R. Stickley (hon. Press steward) and Mr. L. L. Hughes (member of the Executive Committee).

Mr. G. P. Davidson, project and construction manager with the engineering division of the Distillers Co., Ltd., has been appointed head of the nuclear power plant activities of Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

The annual function of the Scottish Section of the **Electrical Wholesalers' Federation** is to take place during the week commencing 1st October at the Gleneagles Hotel, Perthshire.

Invitations have been sent by the Section to the Councils of a number of manufacturers' and contractors' associations. On Wednesday morning the Council will hold a meeting, to which the Scottish members will be invited. Golf competitions have been

arranged to take place on 4th October and a dinner is to be held in the evening.

Sir William Stanier, a former president of the Institution of Mechanical Engineers, has been elected president of the Engineers' Guild for 1957.

The Northern Aluminium Co., Ltd., announces several new appointments in its Sales Department. **Mr. D. W. Taylor,** formerly assistant manager of the company's sales development division, has succeeded **Mr. G. A. Vernon,** who has retired, as manager of the Birmingham area sales office. **Mr. D. A. Pinn,** previously manager of the Bristol area sales office, has been appointed export sales manager. He is succeeded by **Mr. H. M. Louch,** previously manager of the Leeds area sales office, which is now under the management of **Mr. H. Q. Lievesley. Mr. D. L. Roper** has been appointed manager of the Southampton region office, with effect from 1st October, in succession to **Mr. N. P. Campbell** who is to attend a year's course at the Centre d'Etudes Industrielles, Geneva, sponsored by the Aluminium, Ltd., group of companies.

Lion Electronic Developments, Ltd., announces that **Mr. R. Q. Marris** has been appointed a director of the company. During the past three years Mr. Marris has been general manager and his new appointment is part of a general expansion programme in the fields of resin encapsulation and electronics which has already required considerable extension of factory space at Lion Works.

Mr. R. Q. Marris

Mr. B. J. Randall, of the London office of the Electro Mechanical Manufacturing Co., Ltd., has resigned from the company.

Mr. P. J. Fell, A.M.I.E.E., has been appointed district manager of the Nottingham office of A. Reyrolle & Co., Ltd., in succession to Mr. W. B. Fenwick. Mr. Fell, who has already taken up his new duties, served a student apprenticeship with the company before joining the Royal Navy in 1940. After returning in 1946 he had further experience in the Engineering and Contracts Departments at Hebburn and then served as a district engineer in the Manchester and Leeds offices of the company between 1952 and 1st September this year, when he was transferred to Nottingham.

Mr. J. E. Blazeby has been appointed assistant engineering manager (guided weapons) with de Havilland Propellers, Ltd. He was educated at the City of Norwich School and the City of Norwich Technical College. After serving his engineering apprenticeship with Laurence, Scott & Electromotors, Ltd., he was employed by that company as a designer, and later as a sales and estimating engineer. In 1939 he joined the Aeronautical Inspection Department of the Air Ministry, and was subsequently transferred to the Directorate of Aircraft Production. He joined de Havilland in 1944 as chief draughtsman of the test rig and tool drawing offices of the propeller engineering division, and in 1947 was appointed chief draughtsman of all the company's drawing offices.

A record number of students attended the annual students' social of the **Telegraph Construction & Maintenance Co., Ltd.,** which was held on 14th September at Greenwich Town Hall (Minor Hall). Some thirty guests and members of the Telcon Education and Training Committee also attended. In the absence of the technical controller, Mr. H. F. Wilson, on holiday, Mr. W. R. J. Martin, personnel manager and a member of the Education and Training Committee, took the chair. The guest speaker was Dr. O. J. Walker (education officer, I.C.I. Plastics Division), and other guests were Mr. H. A. Warren (principal, S.E. London Technical College), Messrs. H. McQueen and C. W. Robson (S.E. London Technical College), Mr. C. Taylor-Cook (principal, Poplar Technical College), Mr. L. V. Bispham (principal, Woolwich Day College), Messrs. D. H. Welch, T. J. Holliman and C. Darling (Johnson & Phillips, Ltd.) and Dr. E. W. Smith, representing the Telcon board of directors, who presented awards to successful students.

The winner of the golf challenge trophy of the Midland Branch of the **Electrical Trades' Commercial Travellers' Association,** which was played for recently at Moor Hall Golf Club, Sutton Coldfield, was Mr. W. Horrocks. Other prize winners were Messrs. B. R. Fletcher, P. M. King and F. Sprigg.

For their autumn show the **G.E.C. Dramatic Society** chose Basil Thomas's comedy "Book of the Month," which they put on at the Cripplegate Theatre, London, E.C., last week. The action revolves round a young authoress whose rather "daring" book seems likely to involve her family and friends, who have been used as characters in the book, in unpleasant complications. All, however, turns out well. The cast who filled their parts with the ability we have come to expect from this company were Shirley Linge (the young authoress), Austin Mooney and Audrey Anderton (her parents), Brenda Bell (her aunt), Joan Morris (the maid), Douglas Fairweather (a hearty colonel), Keith Clifton (a doctor) and Michael Hobbins (her eventual fiancé). Bunty Hill was responsible for the production and the proceeds of the performances are to be given to the National Spastics Society.

OBITUARY

Mr. W. E. Clark, who in 1952 completed fifty years' service with the English Electric Co., Ltd., died on 30th August at the age of sixty-eight. Mr. Clark was manager of the company's Birmingham and Midlands territory from 1926 to 1953. Since then he had been engaged in consultative duties for the company.

The late Mr. W. E. Clark

Mr. Clark joined Siemens Brothers & Co., Ltd., in 1902 at York Mansions, London. Some two years later, on the formation of Siemens Brothers Dynamo Works, Ltd., he joined that company's Traction Department. Later he was transferred to the Power and Mining Division. When Siemens Brothers Dynamo Works became part of the English Electric Co., in 1919, Mr. Clark moved to Queen's House, and was appointed to the position of deputy to the London branch office manager. In 1926 he was appointed manager, Birmingham and Midlands territory. He was president (1952) of the Midland Electrical Engineers Association; chairman of the Midland Engineers' Club; past-president of the Birmingham Electric Club; hon. treasurer of the Institution of Electrical Engineers Benevolent Fund, South Midland Centre; and a member of the Birmingham Rotary Club representing power engineers. He leaves a widow and one son, Mr. R. A. Clark, who is assistant general manager of the English Electric Co.'s Rugby Works.

Mr. B. H. Musgrave, a director of the Telegraph Construction & Maintenance Co., Ltd., and Submarine Cables, Ltd., died suddenly on 15th September, in Johannesburg, after a heart attack whilst on a visit to Telcon's new factory there. He leaves a widow and two sons. Mr. Musgrave, who was fifty-nine, was appointed an assistant accountant with the T. C. & M. Co. in 1926. His connection with the company, however, dated back much earlier for he received his early training on the staff of the company's auditors, Deloitte, Plender, Griffiths & Co. In 1932 he was made chief accountant and he was appointed secretary of the company in 1938. In 1947 he was elected to the board of the T.C. & M. Co. and a few months later was made a director of Submarine Cables, Ltd.

Mr. H. Nye Chart, sales director of E. N. Bray, Ltd., Walthamstow, London, died on 15th September. Mr. Nye Chart served with the Leicestershire Regiment in the 1914-18 war as a captain and was awarded the Military Cross. Leaving the Army in 1919, he joined the firm of Bray, Markham &

Reiss, who were absorbed by the Electrical Apparatus Co. in 1921. Mr. Nye Chart remained with E.A.C. until 1929 when he joined E. N. Bray, Ltd., as sales manager. He became a director of the company in 1932 and continued as sales director until his death. He was also a director of the Theatre Royal, Brighton, with which his family had been connected for many years.

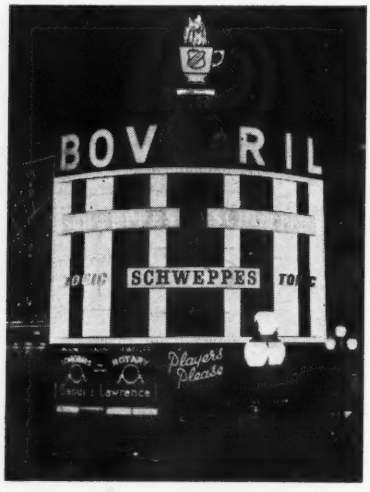
Mr. R. A. Briginshaw, a departmental factory superintendent of the Micanite & Insulators Co., Ltd., died on 15th September at the age of fifty-six. He had been with the company for nineteen years and was previously for twenty-two years with the Metropolitan-Vickers Electrical Co., Ltd.

Dr. Frederick Soddy, F.R.S., Emeritus Lee's Professor of Chemistry in the University of Oxford, died on 22nd September at the age of seventy-nine. Dr. Soddy was a pioneer of research into atomic disintegration, and early in the century was associated with Lord Rutherford in experiments on radioactivity. He received the Nobel Prize for Chemistry for 1921.

New Piccadilly Circus Sign

To Londoners and visitors from overseas, the Bovril illuminated sign in Piccadilly Circus is as familiar as the Eros statue, but the original sign, which has occupied the Shaftesbury Avenue corner of Piccadilly Circus since 1909, became outmoded by the many signs which have been erected in the Circus since the end of the war.

In conjunction with Schweppes, Ltd., a new composite sign has now been erected on the site, and this was formally switched on on Thursday last week at the Criterion Restaurant by Mrs. Emma Bruce, a Piccadilly flower seller; Miss Zoe Gail, the actress, invited Mrs. Bruce to throw the switch.



The new Bovril-Schweppes sign in Piccadilly Circus

The guests at the switching-on ceremony were welcomed by Lord Luke for Bovril, Ltd., and by Sir Frederic Hooper for Schweppes, Ltd.

The sign, which has been erected by the Electric Sign Co., Ltd., is claimed to be the largest ever erected in Piccadilly and occupies an area of nearly 3,000 sq ft incorporating nearly 9,000ft of neon tubing.

The new Bovril sign occupies the top section of the site which is 60ft long and 32ft high at the centre. Letters 8ft high, making up the word "Bovril," are illuminated from behind by three colours of neon tubing in red, blue and green, which light up in sequence. The letters are surmounted by a Bovril cup with steam rising from it.

The Schweppes sign occupies the remaining part of the site, 62ft by 34ft, and was designed by Misha Black, O.B.E., F.F.I.A., M.Inst.R.A., of the Design Research Unit. This section is completely surrounded by a metal border which has a series of white squares and yellow circular motifs in neon tubing.

There are six vertical panels and these are fitted with blue neon tubes, with white circular tubes superimposed to represent bubbles which appear to rise from the base of the sign. On a red neon background is carried the word "Schweppes" in 2ft 8in high, white plastics-faced letters; these are illuminated from within by white neon. Two sets of metal letters reading "Tonic" are also placed on either side of the name.

Accessories Manufacturers' Diamond Jubilee

Founded within two or three months of the exhibition of the first electric lamp in Europe, Dorman & Smith, Ltd., celebrated their 75th anniversary with a dinner at the Midland Hotel, Manchester, on 21st September. Mr. Thomas Atherton, chairman of the company, referred to the starting up of the company in September, 1881, and its development into a group of seven companies manufacturing a wide range of electrical products.

Mr. Forbes Jackson, M.I.E.E., M.I.Mech.E., member of the Southern Electricity Board, who gave the toast of the company, said that its history spanned the whole development of the electrical industry. One of the outstanding achievements in electric wiring in the last twenty-five years had been the introduction of the ring main, for which, of course, it was necessary to have a fused plug. Mr. Jackson said he served on a committee which studied the ring main idea, but no manufacturer was prepared to help by producing a fused plug until he approached Dorman & Smith who, within two or three weeks, produced a prototype. That great development in wiring technique had gone into hundreds of thousands of houses and would go into millions more.

Mr. Atherton said they were founded before the Codes of Practices Committee and the Wiring Rules Committee. Although they were 25 years before the British Standards Institution, they designed safely and their gear was, he thought, heavier and ran cooler in those days than it did to-day when they worked to other people's specifications. The first customers of the company in the early days were the shipowners. A ship, already provided with rotating machinery, was an ideal place for the installation of this new electric light. The early partners used to get their orders at the docks, go back to their small works, then in Brazennose Street, Manchester, design and make the fittings required and then install them in the vessel. From those days developed the different patterns of cast-iron ships' fittings, cargo clusters (which he regarded as the first floodlights) and wiring accessories.

When the use of electric lighting spread so rapidly, the infant industry divided itself into two groups—the manufacturers who designed and made the gear, and the contractors who installed it. Dorman & Smith realised that they could not stay in both fields and decided to leave the contracting side to others.

Mr. Bruce L. Cooper, deputy chairman, proposed the toast of the guests, for whom Alderman E. A. Hardy, Deputy Mayor of Salford, replied.

Watches were presented during the evening to three employees who had completed forty years' service with the company.

PRICES OF MATERIALS

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £197 0s 0d
COPPER, H.C. Electro	ton £299 5s 0d
Fire Refined 99·70%	ton £298 0s 0d
Fire Refined 99·50%	ton £297 0s 0d
COPPER Tubes ..	lb 2s 10⅝d
Sheet	ton £370 15s 0d
H.C. wire and strip ..	ton £334 5s 0d
LEAD, English ..	ton £117 5s 0d
Foreign	ton £116 0s 0d
MERCURY	flask £83 10s 0d
TIN, block (English) ..	ton £797 10s 0d
ZINC, G.O.B. Foreign	ton £97 0s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 2 4¾d
Sheet	ton £299 5s 0d
Wire	lb 3s 0¼d
PHOSPHOR BRONZE Wire	lb 4s 5⅞d
PLATINUM	oz £34 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 26¼d—27d

VIEWS on the NEWS

By REFLECTOR

RECENT references in the *Electrical Review* to income tax rebate on subscriptions to professional bodies are supplemented by a letter to the *Manchester Guardian* from Mr. Stanley Mayne, general secretary of the Institution of Professional Civil Servants. The letter deals primarily with the meagre allowances to civil servants for entertainment purposes but Mr. Mayne goes on to say that:

> "Another factor which concerns a large number in the professional public service, and certainly all those in the Civil Service, is the refusal of the Inland Revenue Department to allow their subscriptions to their learned bodies to rank for income tax relief or even, in the case of veterinary officers and architects, the necessary registration that must be carried out annually if, within the law, they are to practise in their profession. The income tax authorities take the view that if there was a firm requirement to belong to, say, the Institution of Mechanical Engineers, the Royal College of Veterinary Surgeons, or register as an architect and be a member of the Royal Institute of British Architects, then they would recognise the subscriptions as subject to income tax relief. But although an architect must be registered and, indeed, must be a corporate member of the Royal Institute if he is to be appointed as a civil servant, and similarly with other professions, the Treasury take the line that they do not and will not regard it as necessary for these officers to continue in membership of their professional bodies."

Representations made by a considerable number of organisations to the Royal Commission on Income Tax resulted in a recommendation for relief which, unhappily, the Chancellor of the Exchequer has not adopted although, Mr. Mayne avers, the architect or other professional person in private practice is able to secure relief.

* * *

My attention has been drawn to an advertisement in a national newspaper emanating from an American electronic concern calling for applications from British engineers and scientists for positions on their research and development staff. Nothing is said about salaries (which would no doubt be generous) but the attractions listed include "free life insurance, accident and health protection and a liberal vacation policy." It may seem a pity that at a time when we are experiencing a shortage of these types of men attempts should be made to lure them away from this country. But, taking a broader view, such men may not only contribute to the strength of American industry but also acquire knowledge and experience which they may bring back with them later on. It is also possible, of course, that we are attracting a certain number of American scientists and engineers to this country, but this is less likely if they are offered the customary British terms.

* * *

One of our leading electrical manufacturing companies owns an inn—or rather what was once an inn for presumably the licence has lapsed. It is described very interestingly in "English Electric and Its People." Originally, it was the "Lion," one of seventeen coaching inns at Dunchurch, near Rugby, and it acquired some fame as the place where the Gunpowder Plot conspirators met on 5th November, 1605, to await news of events at Westminster (the news wasn't good from their point of view). The premises came into the possession of the English Electric Co. six years ago when the company bought Dunchurch Lodge for use as an apprentice hostel. The old "Lion" was a part of the estate; with it is 4½ acres which is now run as a mixed farm of grass and arable land on which pigs are raised and sufficient potatoes are grown to satisfy the needs of the works canteens and apprentice hostels.

* * *

There are too-frequent reports of "smash-and-grab" raids on radio and television shops and it is therefore refreshing to hear of a case which, so to speak, puts things into reverse. *The Times* reports that the other day a man drove up in a taxi-cab to a television dealer's premises in Tooting, carried out a television set and flung it through the shop window.

* * *

Laconic story from the New York *Electrical World*:—

> "Sixteen-year-old Drum Major Irving Gilman, leading Hamlin, N.Y.'s, fire department carnival parade, flipped his baton high in the air—as usual without looking—and stretched out his hand to catch it. No baton. It was welded to a 5-kV line overhead. A Niagara Mohawk Power Corp crew restored service 75 min later."

* * *

A correspondent sends me a cutting of an advertisement from a local paper which reads:—

> "Lights 30s. Plugs 5os. Electrical Plumbing."

Pointing out that the announcement is in a column headed "Miscellaneous," my correspondent suggests that "electrical plumbing" is probably a good description of work carried out at these prices.

* * *

Electric lighting (or *the* electric light as it was generally called then) was in an uncertain position seventy years ago. The *Electrical Review* of 1st October reported a number of new installations, either of arc lamps or incandescent lamps, and sometimes both. But it also reported the dismantling and sale of the Colchester installation which, to the great delight of the *Gas World*, brought in only £345. The principal lot was a 25 h.p. Davey Paxman "semi-portable" engine and boiler which fetched £200. Three dynamos went for about £96. Another item in the same issue was a complaint about the lighting in the British Museum Reading Room which a habitué said:—"Bobs and blinks until it becomes at times absolutely distressing." A third report was a brief account of a fire caused by the electric light at the Berlin Art Exhibition. The leading article referred to blunders made by some of the electric lighting companies because of inefficient management but was optimistic about the future prospects.

TRANSATLANTIC TELEPHONE CABLE

ON Tuesday last the transatlantic telephone cable was officially opened by Dr. Charles Hill, the Postmaster General, who spoke to Mr. Cleo F. Craig, president of the American Telephone & Telegraph Co., in New York, and Mr. George Marler, Canadian Minister of Transport. The whole project is the successful outcome of a combined co-operation between the American company, the British Post Office and the Crown-owned Canadian Overseas Telecommunication Corporation.

The main feature of the cable, which has cost about £15 million, is that it provides a telephone service between Britain, Canada and the United States which is not susceptible, like radio-telephone circuits, to interruption by atmospheric disturbances. The service will remain open and effective day and night throughout the year. One important advantage of the continuous, reliable service which the new cable will provide is that callers will be able to take advantage of the reduced night and Sunday rates, which is not always possible over the radio circuits since they are subject to interference by atmospheric storms, particularly at night.

The reduced night rates are available to Canada and the U.S.A. as well as some other countries throughout Sundays and from 10 p.m. to 10 a.m. every night. The basic reduced rate is £2 5s for a three-minute call (minimum), compared with the ordinary rate of £3.

Planned and Completed in Three Years

The system has been completed in just under three years since Earl De La Warr as Postmaster General announced in the House of Lords on 1st December, 1953, that he had signed agreements for the construction and laying with representatives of Canada and the United States. Within those three years the system had to be planned and the whole interconnected system of submarine and land cables and radio links had to be manufactured and constructed. The final system designs had to be completed and interlocked without delay, so that manufacture could be put in hand. New machinery and techniques had to be developed for placing the cable in deep waters and the route had to be surveyed and established.

Nearly 4,500 miles of cable had to be made to the most exacting specification ever devised, most of it in a factory which had still to be completed, and 146 repeaters had to be built to withstand the rigours of laying and water pressures at depths of up to 2½ miles under the Atlantic, with components of such fidelity as to last for 20 years at least without attention.

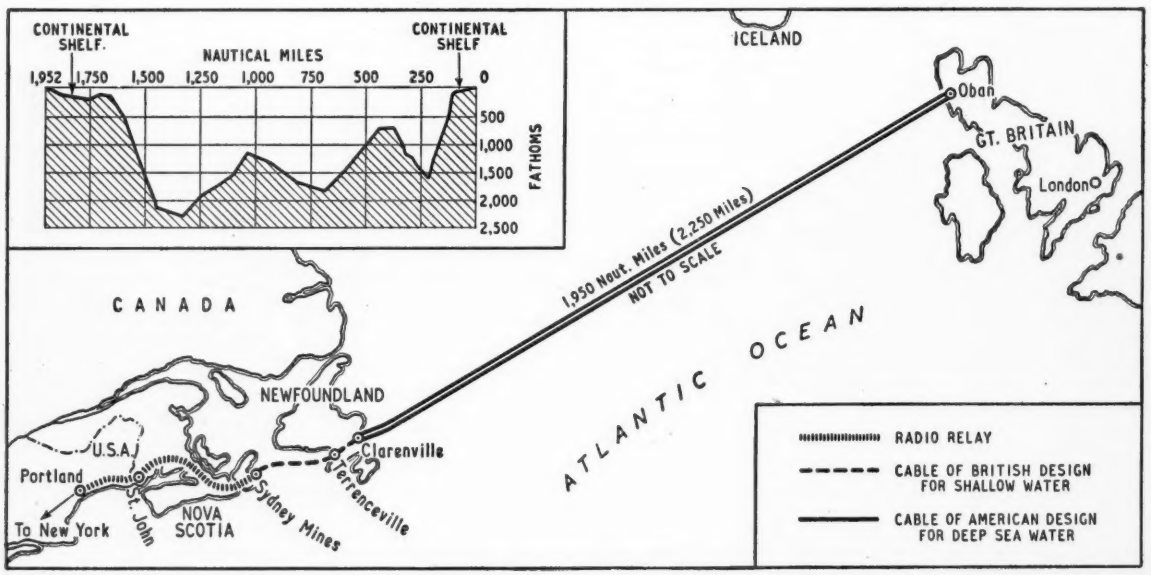
International Connections

The system will carry 35 simultaneous telephone conversations. Any subscriber in Britain, the U.S.A. and Canada can speak over the system through London, Montreal or New York. Subscribers in other countries will be able to use the system through the international telephone network. The cable has also been designed to provide eleven telegraph channels between Britain and Canada, supplementing the existing Cable & Wireless, Ltd., cable (Cornwall-Newfoundland) and the Post Office radio-telegraph circuits. Through Montreal and over the trans-Canada telegraph network, the service will also link with the trans-Pacific cable to Fiji, New Zealand and Australia.

The cable comes ashore in Britain at Oban, Scotland, from which point a new coaxial cable has been laid to Glasgow, where it connects with the carrier cables to London. Calls will be routed to and from the International Exchange, London, through which any United Kingdom subscriber can be connected.

Two one-way cables run 1,950 nautical miles (2,250 statute miles) from Oban to Clarenville, Newfoundland. From this point a two-way cable crosses Newfoundland to Terrenceville (63 miles) and then goes underwater to Sydney Mines, Nova Scotia (312 miles). From Sydney

Diagram of the transatlantic telephone cable route



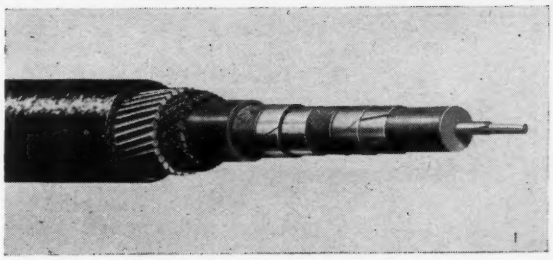
Mines the signals are carried by means of a radio relay link to Spruce Lake, from whence connection is made to the Canadian inland network at Montreal, and on to Portland on the U.S./Canadian border whence connection is made to the United States internal network at White Plains.

To examine the route in more detail, starting in London, there are first 12- and 24-circuit carrier cables over the 450-mile route to Glasgow whence a coaxial cable takes the signals 111 miles to Oban. Later the reserve routing will be via a new coaxial cable between Oban and Inverness and thence to London by an east coast route. Between Oban and Clarenville (2,240 miles) two submarine cables are used for the two directions of transmission, each including 51 flexible repeaters and transmitting three 12-channel groups; the American Telephone & Telegraph Company (A. T. & T.) was responsible for this section. From Clarenville to Sydney Mines (375 miles) one submarine cable, including 16 rigid repeaters transmits five 12-channel groups (that is, one super-group) in each direction; the United Kingdom Post Office was responsible for this section.

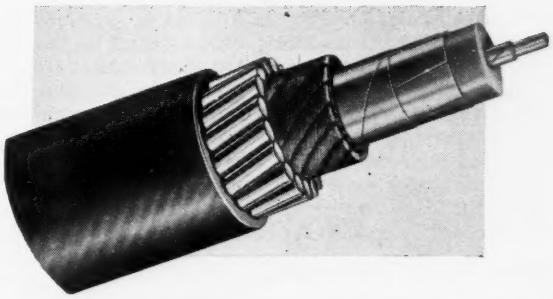
The section between Sydney Mines and Portland (575 miles) is a 4,000 Mc/s radio relay system with 17 intermediate stations. From the relay tower at Spruce Lake, the break-out point for the Canadian circuits, a separate microwave system operates over the intervening 10 miles to St. John, New Brunswick. The Portland to White Plains section (326 miles) uses groups in the A. T. & T. Long Lines network:—Portland-West Haven (271 miles), 12-circuit carrier cable; West Haven-White Plains (55 miles), coaxial cable.

The route between Spruce Lake and Montreal (652 miles) is the responsibility of the Canadian Overseas Telecommunication Corporation, who rent the necessary facilities between St. John and Montreal from the operating companies. The routing is:—Spruce Lake-St. John (10 miles), radio relay; St. John-Quebec (450 miles), 12-circuit open-wire carrier; Quebec-Montreal (192 miles), 12-circuit carrier cable. Thus, the overall lengths of the London-New York and London-Montreal circuits are 4,078 and 4,157 miles respectively.

All but 400 of the 4,500 nautical miles of cable was made by Submarine Cables, Ltd., in a special factory built at Erith, Kent, and the remaining 400 miles by the Simplex Wire Co., Inc., at Portsmouth, New Hampshire, U.S.A.



Sample of the normal land line cable



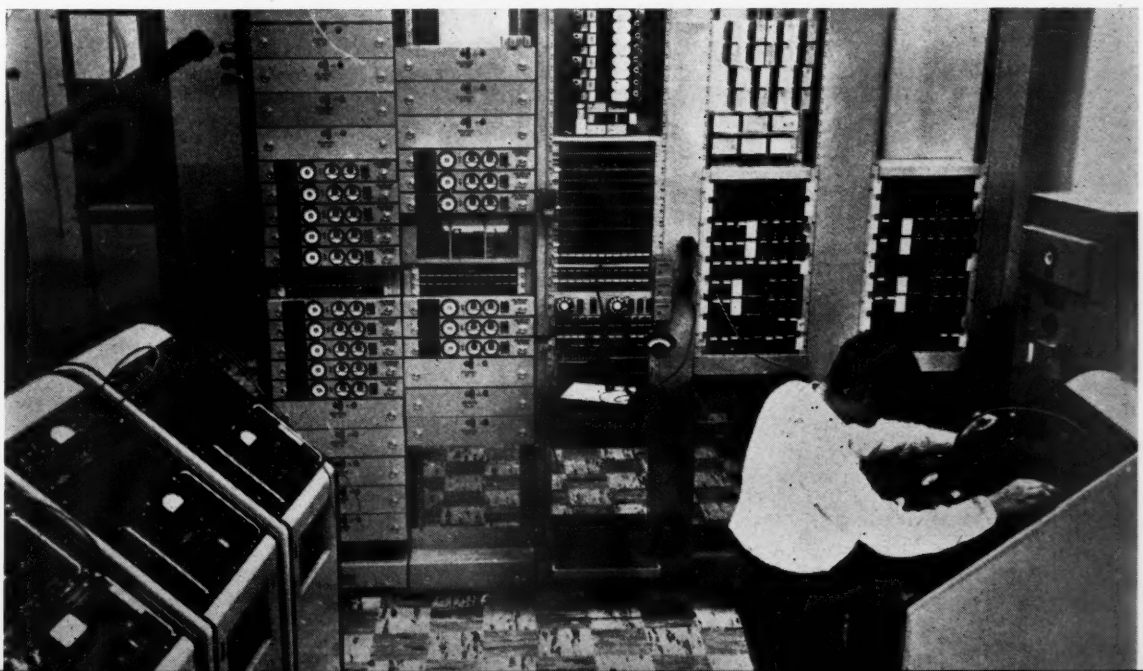
Type "B" submarine telephone cable for intermediate depths

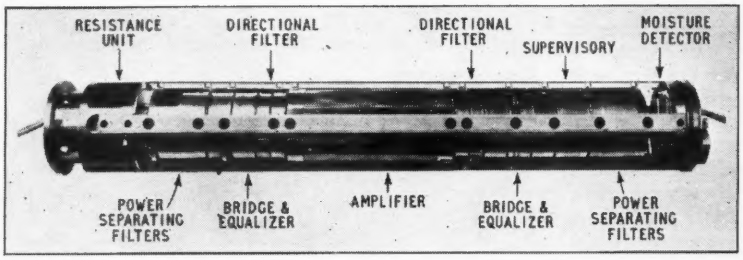
Repeaters are inserted in the cable at intervals to strengthen the signals en route and so ensure adequate reception. Altogether there are 118 repeaters; 102 American type flexible repeaters, which permit only one-way working, are inserted at 37-mile intervals in the two one-way cables on the main Atlantic crossing; in the two-way cable from Clarenville to Sydney Mines, 16 two-way repeaters of British design and manufacture are inserted every 23 miles.

British-made Repeaters

The British Post Office Research Station began work on submarine repeaters, mainly for shallow water cables, in 1938. In 1943 the Station produced a shallow water repeater which was inserted in a cable between Anglesey and the Isle of Man, and since that date many have been used in the submarine cables round the British Isles. In

Interior of Newfoundland Terminal Station





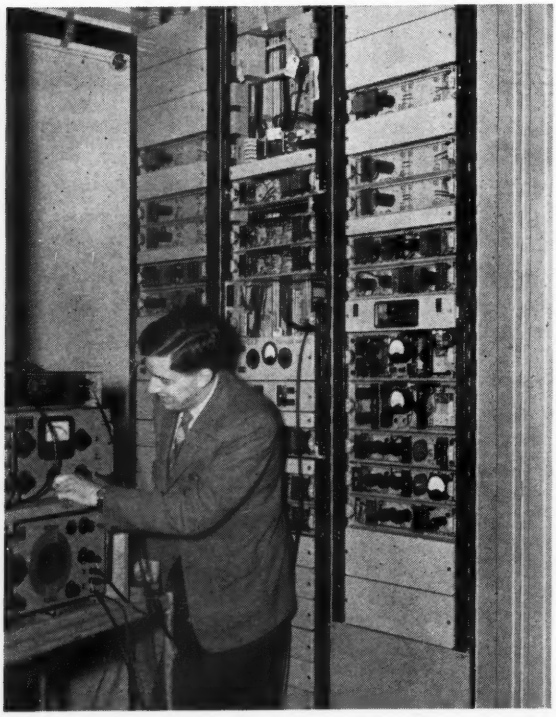
1954 repeaters of a new design intended for use in deep water were inserted in the 300-mile Aberdeen-Bergen cable.

The British repeaters are rigid and arranged for two-way working and are used for shallow water cables, such as those which connect Britain with Ireland and the Continent. In deep water, such as the Atlantic, a continuous laying operation is necessary and no cable ship is yet equipped with the machinery necessary to handle rigid repeaters in this way. The British repeaters used in the transatlantic system were made to Post Office specifications by Standard Telephones & Cables, Ltd.

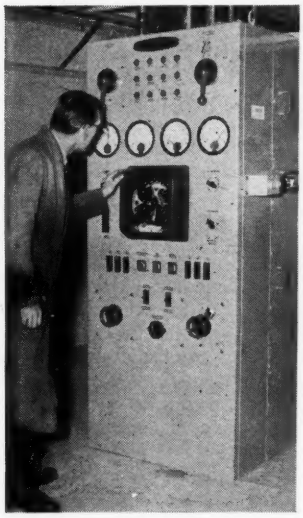
Deep-Water Repeaters

Bell Telephone Laboratories in the United States concentrated their research on deep-water repeaters. Their first repeater was developed in 1941, and the first working repeaters were laid between Key West, Florida, and Havana, Cuba, in 1950. They are less bulky than the British repeaters and, being more flexible and able to pass round the cable drum, can be more easily laid in deep water. On the other hand, they permit one-way working only; hence the need for two cables between Oban and Clarenville, one for each way; in each of them 51 American repeaters are laid at intervals of 37 miles. They were made

Engineer testing frequency base unit in repeater station at Oban Terminal Station



Above: Internal repeater unit before finally sealing



Right: Control cubicle for British continuity sets in Oban Terminal Station

by the Western Electric Co., Inc., at Hillside, New Jersey, and flown to England.

The transatlantic cable was laid by H.M.T.S. *Monarch*, the Post Office cable ship, the only vessel in the world large enough to do the job. She laid the main west-east cable in the summer of 1955 and the main east-west link this summer. The cable across Newfoundland was laid in 1955 by the Canadian Comstock Co., Ltd., and a party of United Kingdom Post Office engineers.

The entire operation of the system depends upon the uninterrupted supply of electrical power at the terminations of the cable and at the relay stations through the country. Power equipment at the terminal station in Britain was designed in collaboration with the British Post Office, and manufactured by the Electric Construction Co., Ltd., and included 36 kW no-break motor-generator sets and associated automatic control gear to provide an uninterrupted a.c. supply to the repeater equipment on which the complete installation is dependent.

Industrial Safety Training Centre

At a meeting of the Birmingham and District Industrial Safety Group held on 18th September, it was announced that the appeal which was made to members early in the year for funds to acquire and equip the new Industrial Safety Training Centre at Acocks Green had been closed. The amount required in the first place was £4,000 and the chairman, Mr. C. D. Lovell, works director of Alfred Bird & Sons, Ltd., said £4,579 9s had been received. The Centre was actually opened on 12th April last by the Minister of Labour, Mr. Iain Macleod. The programme of courses includes those for electrical installation engineers, maintenance workers, etc. At the meeting, Mr. C. D. Lovell was presented with a souvenir album of photographs depicting scenes on the day of the official opening, as a token of appreciation of his work in sponsoring the appeal.

ELECTRIC FIRES

In our series of illustrated surveys of domestic electrical equipment we shall be dealing next week with electric fires. Particulars to be given in tabular form will include details of type, loading, elements, finish, price and purchase tax, etc.

OVERSEAS ELECTRICAL TRADE

Seasonal Decline of Electrical Exports in August

THE holiday season, which reaches its peak in August, is invariably reflected in the reduced value of British exports generally, and electrical goods, in common with most other commodities, showed a decline last month. The total value of exports of electrical goods and apparatus in August was £17,956,663, as compared with £18,598,891 in July. For August, 1955, the value was £19,246,380, but this exceptionally high figure was largely due to shipments which had been held up by the dock and railway strikes.

Practically all classes showed decreases, an exception being wires and cables, exports of which rose by over £300,000 to £3,053,239. In the electrical machinery group, exports of generating plant were valued at £2,576,802 (against £2,705,454 in July), and shipments of converting machinery, transformers, etc., were £2,586,830 (£2,689,268). The radio apparatus section showed a falling off as compared with July of nearly £400,000, last month's total of £2,474,933 comparing with £2,858,115 for July. Telegraph and telephone equipment exports also fell by about £350,000 to £1,649,856.

In the generating plant section, the principal purchaser was Canada which took equipment valued at £335,828,

TABLE I.—ELECTRICAL EXPORTS

Class	August, 1956	Eight months ended August, 1955	Eight months ended August, 1956
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW	113,598	936,797	1,163,334
Ditto, 10 to 65 kW	160,785	1,036,188	1,055,790
Ditto, 65 to 200 kW	100,859	928,249	1,126,746
Ditto, over 200 kW	472,559	3,312,251	2,527,796
Spark ignition engine driven	11,191	156,925	258,309
Steam turbine driven	139,121	1,090,938	610,152
Hydraulic turbine driven	—	368,804	51,786
Other prime mover driven	3,441	228,490	443,211
Generators, not exceeding 200 kW	111,155	1,034,970	989,183
Ditto, over 200 kW	41,117	882,463	609,937
Parts of generators	356,097	3,551,702	4,229,599
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ½ h.p.	143,905	1,623,747	1,535,152
Over ½ but under 1 h.p.	39,933	498,541	462,364
1 h.p. to 250 h.p.	434,321	2,963,966	3,384,297
Over 250 h.p.	58,626	567,542	568,275
Railway, tramway and trolley-bus motors complete and parts of all motors	164,953	1,232,699	1,310,310
Motor starting and controlling gear	225,141	1,537,682	1,892,669
	2,576,802	21,951,954	22,218,910
Converting machinery	36,701	304,149	280,393
Mercury-arc rectifiers	71,516	581,586	561,129
Transformers for lighting, heating and power (incl. coils)	1,093,553	7,041,071	8,578,578
Switchgear and switchboards (not telegraph or telephone), up to 200 A and 660 V	266,368	2,113,287	2,212,315
Ditto, other	1,118,692	7,829,285	9,414,860
	2,586,830	17,869,378	21,047,275
Primary batteries:			
Lighting	100,363	556,174	660,328
Radio	252,400	1,359,047	2,000,400
Other	48,060	296,115	352,744
Parts (excl. carbons)	35,203	263,463	306,350
Lamps:			
Filament, exceeding 24 V	91,524	709,792	811,003
Ditto, under 24 V	33,746	237,837	248,020
Arc lamps and searchlights	15,616	100,546	165,819
Discharge lamps, fluorescent tubes, etc.	88,615	534,370	576,419
Radio and television, etc., apparatus:			
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury arc rectifiers), photo-electric cells, stabilizing and cold cathode valves, magnetrons, klystrons	32,280	157,155	220,030
Cathode-ray tubes	55,516	82,133	250,119
Other valves (not X-ray)	250,831	1,404,509	1,739,019
Parts (excluding glass bulbs)	7,736	183,468	85,052
Radio and television transmitters	92,616	460,586	759,377
Commercial radio and radar equipment	970,017	7,928,367	9,523,677
Domestic radio receivers, mains	89,842	1,261,703	1,043,884
Ditto, battery	70,815	510,725	626,844
Ditto, other (incl. car)	18,217	156,876	196,728
Radiograms	33,621	347,341	283,932
Television sets	33,657	144,283	311,437
Public address equipment	72,168	645,161	691,659
Sound reproducing app., n.e.s.	36,660	190,768	267,849
Components and parts, n.e.s.	710,957	4,635,043	5,479,275
	2,474,933	18,108,118	21,478,882
Telegraph and telephone installations	582,409	5,213,199	4,956,576
Telephone instruments, separately consigned	177,365	725,866	1,117,681
Telegraph and telephone parts	684,963	3,776,374	5,088,690
Line apparatus for long distance commun.	205,119	581,116	1,668,689
	1,649,856	10,296,555	12,831,636

Class	August, 1956	Eight months ended August, 1955	Eight months ended August, 1956
	£	£	£
Cookers	57,140	969,679	638,047
Toasters	24,316	264,240	188,846
Other cooking apparatus	30,466	239,526	288,481
Parts and accessories	55,497	550,191	646,586
Space heating appliances	22,323	292,534	288,006
Water heating appliances	37,142	247,719	273,553
Other heating appliances	28,024	218,914	312,652
Parts and accessories	55,564	560,434	500,550
Irons	70,370	798,793	755,251
Arc welding equipment, a.c.	46,168	259,463	443,628
Ditto, d.c.	69,863	227,557	390,386
Resistance welding equipment	17,801	158,435	153,405
Electric furnace plant	63,951	417,967	472,898
Magnetos, ignition	8,879	127,227	216,214
Sparking plugs	245,294	1,201,315	1,356,365
Elec. appliances for aeroplanes, n.e.s.	201,007	1,484,234	1,713,780
Ditto, for motor vehicles, n.e.s.	367,806	2,384,526	2,872,471
Ditto, for cycles, n.e.s.	40,444	578,578	516,426
Signalling app. (incl. traffic signals)	85,596	379,609	521,727
Industrial radio-frequency equipment	17,918	113,672	94,749
Bell app. (not telegraphic or telephonic)	7,336	66,659	71,133
Instruments, commercial	172,671	1,147,298	1,398,562
House service meters (including parts)	183,493	976,919	1,350,258
Electro-medical apparatus (not X-ray)	44,404	376,887	446,948
X-ray apparatus (excl. tubes and valves)	75,968	494,644	532,163
Vacuum tubes	39,011	163,838	237,983
Ceiling fans, complete	107,553	679,173	867,083
Desk fans, complete and parts of desk and ceiling fans	46,760	237,431	296,324
Vacuum cleaners	154,922	1,045,105	1,139,089
Floor polishers	58,205	725,410	601,395
Food mixers	47,951	385,097	503,912
Hair clippers and dry shavers	48,388	592,871	529,430
Other portable appliances	22,211	355,500	241,358
Parts	90,069	596,060	918,620
Portable elec. tools (not saws) and parts	174,295	1,465,239	1,693,580
Cables and wires:			
Telegraph and telephone, submarine	14,066	535,817	1,456,193
Ditto, other	1,039,058	4,077,872	6,924,565
Cotton, silk or art. silk insulated	37,331	400,319	438,746
Enamel, glass or asbestos insulated	137,149	585,249	805,442
Paper insulated	883,100	5,571,064	7,531,183
Rubber insulated	603,181	3,748,067	4,262,389
Thermoplastic insulated	127,764	657,999	1,108,963
Other	211,590	1,560,726	1,825,838
	3,053,239	17,137,113	24,353,319
Accumulators for motor vehicles	146,441	1,182,226	1,359,294
Ditto, traction	47,763	133,982	205,130
Ditto, radio and other portable	93,460	466,580	707,042
Ditto, other	13,696	200,069	486,769
Parts and accessories	108,871	726,491	720,945
Elec. porcelain, etc. (incl. insulators)	122,668	726,761	918,332
Insulating cloth and tape	81,274	475,178	503,131
Other insulating material	87,870	734,232	825,001
Permanent magnets	40,125	360,496	357,834
Radio, telegraph and telephone testing equipment, n.e.s.	42,682	327,133	347,539
Scientific elec. instruments (not telegraphic or telephonic):			
Time recorders and time switches, complete	19,653	215,404	116,486
Other	288,630	1,697,476	1,693,169
Electrical machinery, n.e.s.	153,088	815,686	984,478
Electrical apparatus and appliances, n.e.s.	884,449	4,726,363	6,229,850
TOTAL	17,956,663	122,973,283	145,977,964

TABLE II.—DISTRIBUTION OF EXPORTS OF ELECTRICAL MACHINERY, APPARATUS AND APPLIANCES

Country	August, 1956	Eight months ended August, 1955	Eight months ended August, 1956
	£	£	£
Channel Islands	71,341	441,417	575,942
Gibraltar	10,030	139,985	277,980
Malta and Gozo	44,055	366,960	469,319
Cyprus	82,400	749,549	1,078,989
Sierra Leone	31,365	176,804	205,473
Gold Coast	158,081	1,088,444	1,133,799
Nigeria	265,322	1,989,159	2,328,656
Union of South Africa	1,444,229	11,861,653	10,607,811
Rhodesia and Nyasaland	462,523	3,201,089	4,151,188
Tanganyika	63,132	616,728	442,928
Kenya	192,945	1,339,076	1,833,653
Uganda	66,119	693,091	583,525
Anglo-Egyptian Sudan	55,645	645,489	627,573
Mauritius	19,531	226,878	189,044
Aden	38,628	335,863	387,570
Bahrain, Qatar and Trucial States	115,885	616,104	700,834
Kuwait	257,641	725,577	1,000,715
India	1,958,886	10,229,367	14,322,065
Pakistan	287,946	2,686,159	2,438,562
Singapore	298,016	2,527,148	2,401,891
Federation of Malaya	239,647	1,859,940	2,115,055
Ceylon	277,517	880,887	1,486,276
British North Borneo	17,638	172,776	196,249
Sarawak	10,025	142,871	131,542
Hong Kong	165,111	1,206,870	1,656,355
Australia	1,730,659	13,477,051	15,133,929
New Zealand	892,291	7,954,150	7,138,604
Fiji	31,495	145,729	165,438
Canada	1,113,584	5,149,941	8,655,042
Jamaica	61,595	689,067	808,509
Barbados	17,565	143,368	203,841
Trinidad	83,801	687,052	838,979
British Guiana	27,746	376,335	313,663
Other Commonwealth countries	106,431	817,730	711,669
Irish Republic	249,032	2,620,048	2,344,702
Soviet Union	140,240	1,881,239	1,886,111
Finland	172,905	1,029,730	1,207,790
Sweden	404,253	2,665,478	2,695,962
Norway	211,149	2,431,952	1,721,200
Iceland	4,994	92,602	110,029
Denmark	192,085	1,152,228	1,430,245
Poland	15,425	171,487	198,978
Western Germany	151,142	1,258,468	1,382,343
Netherlands	632,838	4,463,450	4,941,902
Belgium	211,000	1,899,529	2,210,485
France	251,896	2,127,747	2,484,420
Switzerland	99,470	697,134	776,349
Portugal	194,969	1,664,196	1,332,425
Spain	299,483	1,051,829	2,960,339
Italy	216,744	1,843,125	2,197,061
Austria	43,968	420,431	295,245
Yugoslavia	12,414	536,804	397,599
Greece	263,808	738,923	1,872,508
Turkey	44,132	741,352	574,007
Belgian Congo	23,181	200,564	223,505
French Morocco	28,431	240,989	326,749
Portuguese East Africa	24,343	141,529	172,462
Egypt	225,687	1,117,580	1,554,677
Libya	36,750	146,368	192,997
Syria	113,863	229,605	541,743
Lebanon	37,220	258,263	450,983
Israel	73,993	281,643	759,686
Jordan	61,855	247,339	452,752
Saudi Arabia	204,115	530,070	984,824
Iraq	340,622	1,592,111	2,622,381
Iran	336,808	512,269	1,582,648
Burma	104,032	1,251,925	983,504
Thailand	35,706	1,048,280	738,937
Indonesia	63,670	222,062	434,348
Japan	81,247	698,554	515,830
United States	602,612	3,329,874	6,535,545
Cuba	37,674	193,734	302,546
Mexico	93,824	298,387	550,782
Colombia	80,890	640,620	623,926
Venezuela	200,508	1,749,584	2,201,227
Peru	49,238	307,594	416,269
Chile	14,271	215,938	214,280
Brazil	45,733	356,510	1,404,852
Uruguay	2,985	282,941	82,001
Argentine Republic	102,529	1,211,863	641,555
Other foreign countries	424,104	1,819,028	2,134,587
TOTAL	17,956,663	122,973,283	145,977,964

other important markets being India (£299,826) and South Africa £165,310). Australia was the leading buyer of converting machinery, transformers, etc., with a value of £480,091, India (£383,025) and South Africa (£362,358) occupying second and third places respectively. Australia also led in the purchases of radio apparatus with a total of £234,326, and was followed by the Netherlands (£228,250), Canada (£172,583) and India (£157,290). In the telegraph and telephone group, the main importing countries were South Africa (£306,190), Australia (£203,894) and India (£157,542). India was by far the best customer for wires and cables and took supplies valued at £473,602. Second place was taken by New Zealand (£240,122) and third by South Africa (£157,162).

In addition to the equipment and apparatus shown in Table I, the Board of Trade returns give particulars of exports of electrical equipment not included in the electrical section of the returns. These include the following:—

Electrically operated washing machines, complete, not exceeding 150 lb net weight: August, £288,177; eight months, £2,376,533 (£2,130,484). Ditto, 150-250 lb net weight: August, £81,893; eight months, £802,908 (£886,446). Parts: August, £51,655; eight months, £554,718 (£441,238).

Electric lighting fittings and lanterns, complete, with or without bulbs (excluding arc lamps, searchlights and cycle lamps): August, £133,579; eight months, £1,152,383 (£871,920). All other electric lighting appliances (excluding vacuum tubes and lamp bulbs), accessories, fittings and parts: August, £305,012; eight months, £2,621,412 (£2,439,676).

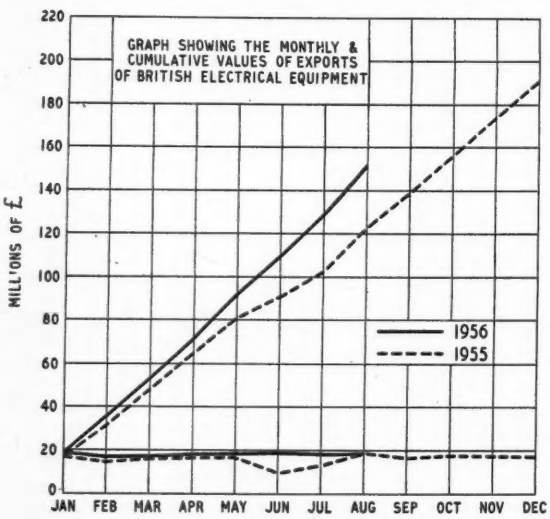
Electric carbons, including parts: August, £45,939; eight months, £390,383 (£327,184).

Welding electrodes (excluding carbon), covered: August, £95,693; eight months, £900,791 (£828,013).

Electric conduit tubes and cased tubes: August, £105,919; eight months, £586,131 (£436,325).

Electric locomotives: August, £234,605; eight months, £1,572,329 (£1,406,416). I.c. engine locomotives with electrical transmission: August, £817,303; eight months, £6,498,938 (£3,618,090).

The distribution of electrical machinery and apparatus given in Table I is shown in Table II.



Imports

Imports of electrical equipment continued to fall, the value in August being £1,642,180, as compared with £1,820,108 in the previous month and £2,210,312 in August, 1955. For the eight months, the total imports were £15,445,448 (against £15,153,569 for January-August, 1955). The United States were the chief suppliers in August with a value of £496,203. Western Germany took second place with a value of £282,312, and the Netherlands were third with £209,387. Once again radio and electronic equipment was the principal class of imports.

Automatic Circuit Reclosers on Rural H.V. Lines

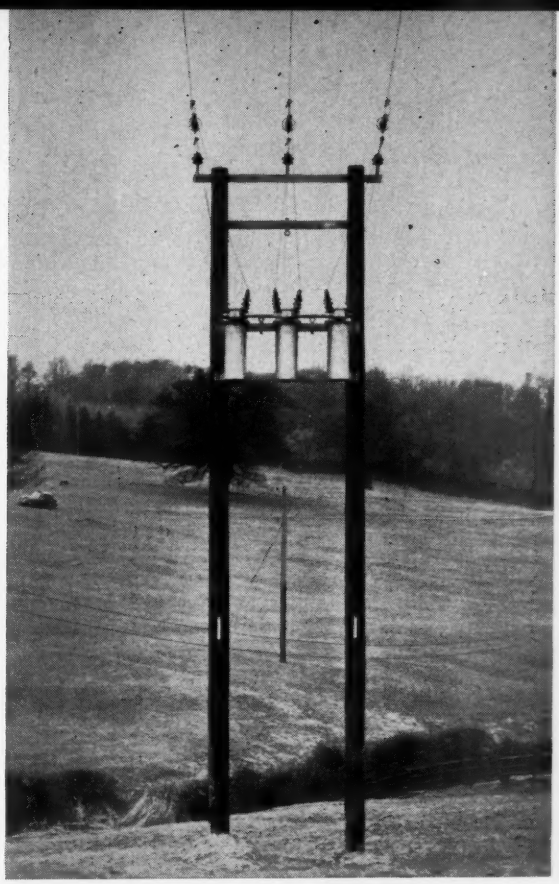
Successful Operational Experience

By R. MALLET, B.A., M.I.E.E. and
N. C. HEATHCOCK, B.Sc., A.M.I.E.E.*

IN Great Britain h.v. and m.v. distribution in urban and suburban areas is almost invariably by means of underground cable. These cables if operated within their rating are inherently reliable. Furthermore, the density of the load and the short distance involved have permitted the provision of alternative supply arrangements to the majority of consumers, by interconnection both on the h.v. and m.v. distribution systems at an additional cost which is justifiable and relatively small.

General experience has shown that a fault expectation of approximately six faults per 100 route mile years is typical for an 11 kV underground system. In many cases these faults do not cause an interruption to consumers' supply, and if they do the supply can be rapidly restored by alternative feeding arrangements. These factors taken together have, therefore, given rise to a very high standard of continuity of supply.

On the other hand in rural areas, overhead lines are normally used both for the h.v. and m.v. distribution systems. The distances to be covered are, of course, much greater and the load density and revenue much lower. On the score of economics, therefore, only overhead lines can normally be considered and limited interconnection only can be provided. Quite apart from the saving in cost with overhead lines, the provision of pole mounted switchgear and small substations is much less costly than is the case of similar equipment connected to underground systems.



Automatic reclosers installed on an 11 kV line in the Midlands

Overhead lines are, however, prone to a comparatively large number of faults, due mainly to lightning surges, gales, etc. Again, owing to the large distances involved, it is not possible on economic grounds to provide extensive interconnection or alternative feeding arrangements. Furthermore, on an expanding system, frequent interruptions to the supply have to be made to provide for modifications and additions, quite apart from those required for essential maintenance work. All these factors have meant that consumers in rural areas have had to put up with a relatively much lower standard of continuity of supply than those in urban and suburban areas. Indeed, a figure of 30 interruptions per 100 route mile years on an overhead 11 kV system is not in any way abnormal. With the ever-increasing use of and dependence on electricity in rural areas, consumers are increasingly calling for a standard of continuity of supply approaching that enjoyed by the town dweller.

Interruptions to supply on overhead line distribution systems fall into two main categories. Those which are "transient" i.e. incidents where no repair work is required before the supply can be restored, and those which are "persistent" i.e. where repair work must be carried out before the supply can be restored.

Table I shows an analysis of the faults over a period of two years on a typical 11 kV system. It will be noted that lightning is the cause of the largest number of faults both transient and persistent. Although line patrols are carried out after every interruption, the cause of operation of quite a large number of fuses or switches remains

TABLE I
ANALYSIS OF FAULTS ON A TYPICAL 11 kV OVERHEAD SYSTEM OVER A TWO-YEAR PERIOD

Cause	Persistent Faults	Transient Faults
Lightning (transient)	—	318
Unknown	—	118
Birds (midspan)	10	41
Gales	14	22
Birds at pole	3	26
Lightning (persistent)	24	—
Maliciousness	13	4
Insulators	17	—
Vermin	1	14
Trees	4	8
Total	86	551
Faults per 100 mile years (based on 2,400 mile years) ..	3·5	23·5

DETAILS OF THE 11 kV SYSTEM COVERED BY ABOVE

Length of overhead line at end of two year period = 1,303·8 miles
Number of positions at which 48/100 A fuses are fitted = 767
Number of positions at which 24/50 A fuses are fitted = 127
Approximate number of pole mounted sub-stations = 2,600
Number of pole mounted weight operated reclosers = 24
Number of reclose relays fitted to 11 kV feeders at primary sub-stations = 25

* The authors are with the Midlands Electricity Board.

unknown. All such faults are naturally regarded as transients, the supply having been restored without any repair work.

More than half of the faults due to various other causes were also classified as transients. However, the authors consider that many of the faults which had become persistent would not have done so had rapid clearance of the fault taken place, such as would have been the case if automatic reclosers had been installed. In an attempt, therefore, to get a true picture of the conditions where reclosers are installed, an analysis of the faults which had been recorded as persistent has been carried out and a certain number have been reclassified in Table I as transients.

The rather surprising conclusion which can be drawn from Table I is that if it were possible to eliminate all transient faults the standard of continuity of an overhead system could be better than that of an underground system.

It would, of course, be easy to eliminate any serious inconvenience from transient faults by connecting extensive sections of overhead systems solidly on to switches fitted with automatic circuit reclosing devices at main substations. Such an arrangement, however, has the disadvantage that when a persistent fault occurs the shutdown would cover a very large area and furthermore, the location of the fault, involving line patrols would be a very lengthy procedure. Indeed, prior to the war there had been a tendency on the part of many undertakings to break up rural systems by the very widespread installation of h.v. fuses. This arrangement, while localising the interruptions due to a persistent fault, gave rise to very large numbers of transient faults, particularly during periods when lightning was prevalent.

Finding the happy medium between the two extremes quoted has been the engineers' job, and the present tendency is to limit strictly the number of fuse installations. In practice, it often takes far longer to replace a fuse or close a switch than would at first sight be apparent. Isolated incidents can be dealt with quickly, but when a thunderstorm occurs in a locality, the staff concerned may be overwhelmed. Telephoned information from consumers may be delayed or confusing, and even with the extensive use of radio by the operating staff, some small groups of consumers may not have their supply restored for more than 12 hours. In the case of the system referred to in Table I, 72 separate interruptions were caused by one thunderstorm, and of those no fewer than 30 were in one district.

The system referred to in Table I is fairly typical. A proportion of the feeder breakers at the primary substations feeding into the overhead h.v. distribution are equipped with automatic recloser mechanisms, employing a d.c. solenoid, the auto-reclosing relays being set to give two automatic reclosures at 30 sec intervals followed by a lock-out. Some of the main spurs are equipped with weight-operated reclosers capable of carrying out six reclosures at approximately 30 sec intervals. Reclosers of this type are in general use, but difficulties have been found in obtaining reliable discrimination between these reclosers and the fuses installed on the system, even under persistent fault conditions and, of course, under transient fault conditions the fuses normally clear first.

The main protection on the system is provided by the installation of h.v. fuses. A standard liquid type fuse rated at 48 A continuous current is employed for the protection of the main line from faults on groups of transformers on spur lines, and on transformers on the main line, other than those of 25 kVA capacity or less where 24 A fuses are used.

In addition to the equipment referred to above, numerous section switches are installed to assist in locating faults and minimising the length of line affected by a fault. The type of equipment and the method of installation are in general use, and indeed, the interruptions quoted in Table I are also believed to be typical.

At one time many engineers believed that arc suppression coils would provide a very appreciable improvement in standard of supply on overhead h.v. distribution systems. In practice, however, the need to provide a higher insulation level than would otherwise be the case in order to reduce the possibility of cross-country phase-to-phase faults, and also the need to retune the coil with varying system arrangements has led to a decreasing popularity of this type of equipment, and certainly its use on 11 kV systems in this country is not being expanded.

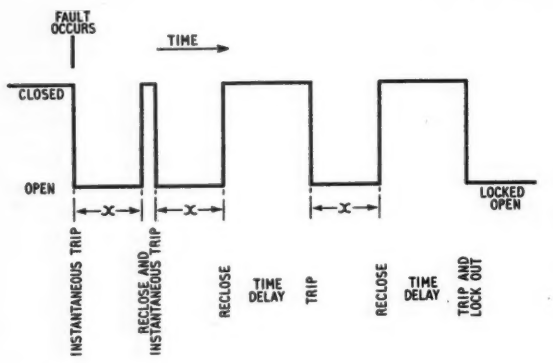


Fig. 1.—The operating cycle of a recloser of British manufacture

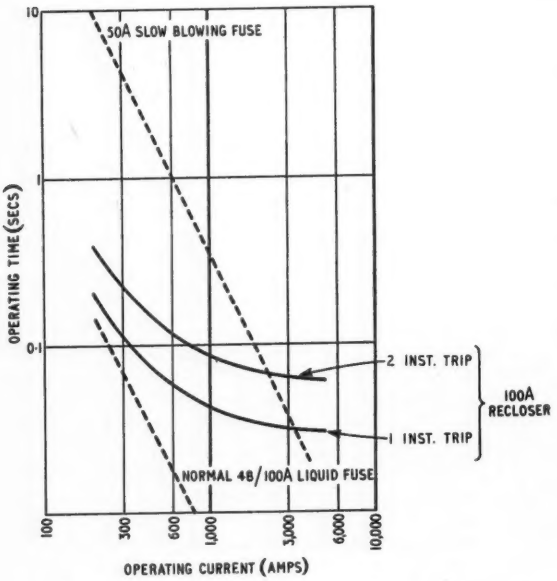


Fig. 2.—Comparison of a fuse characteristic with an instantaneous trip

New Type of Recloser

The apparatus and equipment described previously have been in general use in this country for many years. In August, 1955, however, a new type of recloser of British manufacture became available. This recloser has quite different characteristics and operates on different principles from the conventional type in use in this country. The first equipment employing these special principles was developed by the late Mr. G. A. Mathews, of the Detroit Edison Company of the U.S.A. during the war, and is

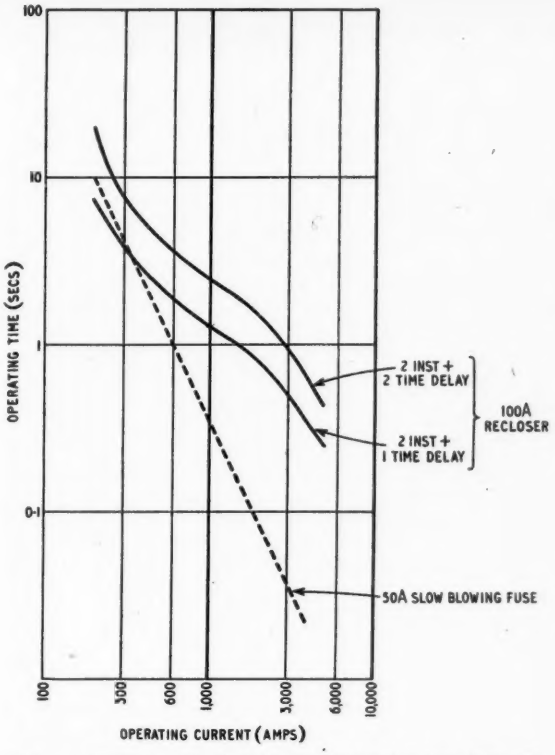


Fig. 3.—Comparison of a fuse characteristic with a time delay trip

described in his paper presented to the Edison Electric Institute of America in May, 1940.

During the early post-war years many thousands of reclosers employing this new principle were installed in the U.S.A. but very little information percolated through to this country. Indeed, so far as the authors are aware the only published reference in this country to these reclosers was made in Mr. G. T. Garwood's I.E.E. paper on "Phase/Neutral Systems of Supply for Rural H.V. Systems," which was presented in 1949. Only brief reference, however, was made to these reclosers in this paper, and their possibilities attracted little attention during the discussions on the paper in various centres. At the end of 1949 the Productivity Team from the Electricity Supply Industry visited the States and at an early stage of the tour, one of the authors, who was a member of the Team, had the good fortune to meet the late Mr. G. A. Mathews. The possibilities of these reclosers were realised and the report subsequently published drew strong attention to the desirability of their installation in this country.

Discussions took place with various British manufacturers early in 1950, and a number of American type reclosers were imported by the Midlands Electricity Board in order to obtain practical experience. The Board also set up a testing station for studying the operational and co-ordination characteristics of the reclosers and various types of h.v. fuses and these tests led to the development of suitable liquid type slow-speed fuses. The development of a British recloser took longer than had been anticipated and the unit finally developed differs in many respects from the American units, and indeed, has some advantages, although regrettably not at present on the score of cost.

The main features of this type of recloser are firstly, a high speed of operation. The recloser has two high-speed trips followed if the fault persists by two time delay trips: the speed of operation on the high-speed trip is such that the recloser operates more quickly than suitably co-ordinated h.v. fuses, and thus clears transient faults with only a momentary interruption of supply.

Secondly, the recloser depends on the actual fault current to operate the mechanism of the inter-trip circuit. It can, therefore, operate repeatedly without attention on transient faults; in fact one of the American reclosers installed on the Board's system operated 209 times under conditions giving rise to frequent flashovers due to salt deposit on insulators.

Thirdly, owing to the use of a series operating coil, the recloser cannot be installed in positions where the fault level is high. In practice, however, this places very little restriction on the proper use of these reclosers.

Operating Characteristics

The operating cycle of the recloser is shown in Fig. 1. When a fault current first occurs the recloser trips very rapidly, in fact within two cycles if the fault is severe. The recloser remains open for one second before reclosing, allowing, in the case of a transient fault, time for the arc to become de-ionised or for any object like a twig or bird to fall clear. If the fault still persists then the recloser carries out another fast trip, together with a second reclosure after a one second interval. These two fast shots are normally sufficient to clear all transient faults. If the fault is persistent, then the recloser trips again, but on this occasion a time delay mechanism is applied, consisting of an oil dashpot, the valve of which is normally open. For the time delay trip the valve is closed and the oil is allowed to emerge through a very small jet. This time delay trip enables a fuse to operate if the fault is on a fused section of the line. If the fault is still not isolated then the recloser carries out another time delay trip and on completion of this operation, locks out.

The operating characteristics of the recloser are shown in Figs. 2 and 3, together with the characteristics of normal liquid fuses and the slow blowing fuses which are required to give proper discrimination when a recloser is used. For the sake of simplicity no attempt has been made to indicate the effect on the fuse operating characteristics of the repeated application of the fault current as the recloser goes through its cycle of operations. It is, of course, apparent from the curves that fuses with slow blowing characteristics are essential.

The reclosers are designed as single-phase units, three such units being coupled together for three-phase operation. This arrangement has the advantage that each phase unit is complete in itself and will go through its own full operating cycle without affecting the other two units, allowing three-phase motors to continue operating in the event of a single-phase transient fault. If, however, one of the units goes through to lock-out then it also trips the other two units and all three phases are opened. After the lock-out the reclosers must be closed manually by means of an operating rod.

The timing mechanism is so arranged that the recloser closes on to a time delayed trip, which prevents the recloser tripping on in-rush current. The timing mechanism is self re-setting, so that after the completion of any portion of the operating cycle the mechanism re-sets itself ready for a further full cycle of operations, the time taken for this re-setting procedure being approximately three minutes. Providing the recloser does not go through to lock-out, it will complete an unlimited number of reclosures without requiring any attention.

Installation of Reclosers

A typical section of h.v. system showing the position of a recloser and associated fuses is shown in Fig. 4. The

system is planned so that transient faults are automatically cleared and the minimum section of network is isolated for a persistent fault.

If a transient fault occurs on the main line section "A-B," then all the consumers fed by this main line, including those fed by the spur line at "C" will experience a 30-second interruption while the circuit-breaker at the primary substation opens and then automatically recloses. If a persistent fault occurs on this main line section then, of course, all consumers have their supply cut off.

If a transient fault occurs on the spur line over section "C-D" or any of the branch lines connected to this spur, then the fault will be cleared by the recloser at "C" and all the consumers on the spur and branch lines will experience an interruption on their supply for only one second. If the fault is persistent and is on the section of the spur line between points "C" and "D," the recloser will go through to lock-out and the supply will be interrupted to all the consumers on the spur line and associated branch lines.

If, however, a persistent fault occurs on one of the branch lines or transformers on the spur line "C" and "D" then all the consumers on the spur line and branch lines will have two one-second interruptions while the recloser carries out its two high-speed trips. Following this the faulty branch line or transformer will be isolated by the operation of the appropriate fuse, while the recloser is prevented from opening by the time delay mechanism which is brought into operation. If the appropriate fuse does not clear during the first of these delayed operations, a second delayed operation will be carried out automatically.

In the case of persistent faults the minimum number of consumers is affected, and the location of the fault by line patrol becomes a simple and rapid matter.

To plan the installation of reclosers the maximum of

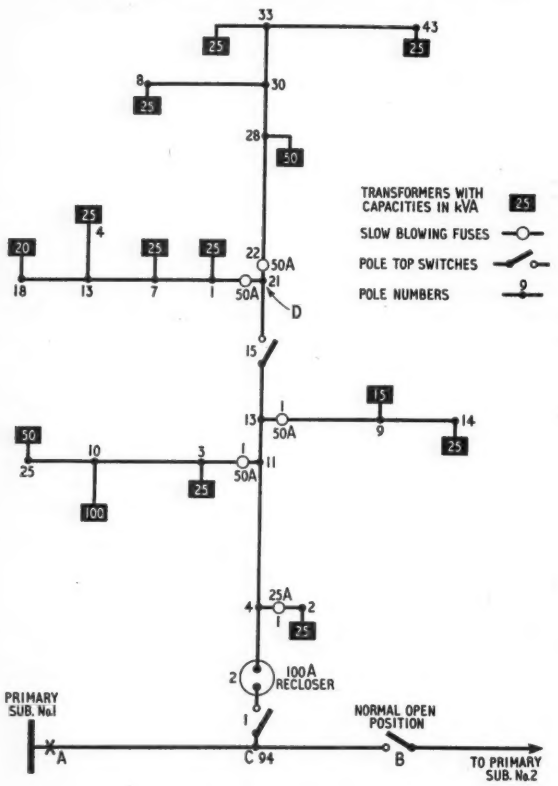


Fig. 4.—Layout of a typical 11 kV system

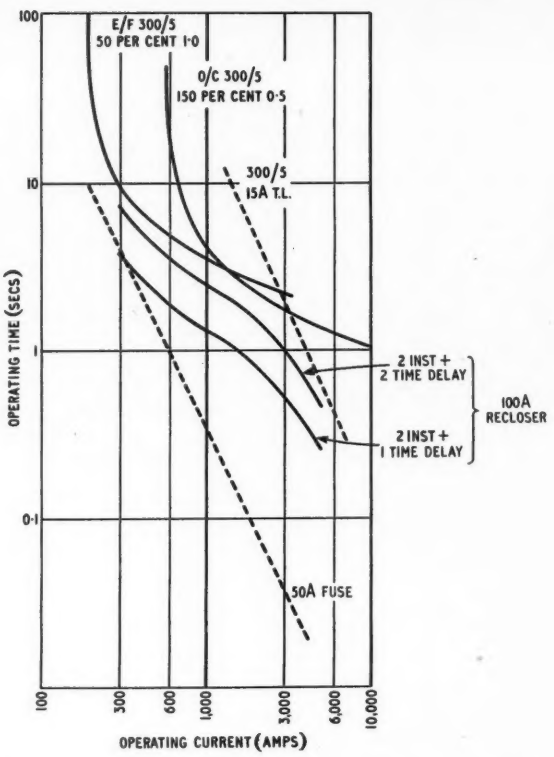


Fig. 5.—Co-ordination of "back-up" protection with time delay trip

fault current at various points over the section of line concerned must be calculated. Table II shows the range of fault currents over which co-ordination could be obtained between the British recloser and typical liquid type slow-speed fuses. It will be noted that this table also gives the minimum fault currents over which appropriate discrimination could be expected and incorrect discrimination may take place at very low values of fault current.

It will also be seen from Table II that the 100 A and 50 A reclosers must not be installed at points where the fault level exceeds 50 MVA. This limitation is not serious in practice as the fault level on rural overhead lines radiating from the primary substation falls very rapidly and is usually below 50 MVA at any distance greater than two miles from even a major primary substation. In the case of long overhead lines where the fault current is low, the load is usually correspondingly low and reclosers with smaller current ratings can then be used satisfactorily.

"Back-up" Protection

Overcurrent "back-up" protection can normally be obtained satisfactorily. Fig. 5 illustrates the co-ordination between the time delay operation of the recloser and a standard two-second relay for a primary current setting of 450 A, and a time setting of 0·5 sec. Also shown is the discrimination obtainable with a 300/5 current transformer with a 15 A time limit fuse.

To obtain "back-up," earth fault protection time settings higher than normal must be used and a curve is shown in Fig. 5 for an earth fault relay set to a primary current of 150 A with a time setting of one second.

"Back-up" settings can, of course, be considerably reduced if a 50 A recloser is used in place of the 100 A unit shown in Fig. 5. The current-carrying capacity of a recloser is limited by the thermal rating of its series coil,

and some advantage can be taken of cyclic loading, the 50 A recloser remaining stable up to 75 A.

Erection and Maintenance

The reclosers are not designed to be maintained or repaired in the field, and should be returned to the workshops for this type of work. They are fitted with counters clearly visible from the ground, and until more experience has been obtained, it is considered advisable that the units should be inspected every twelve months, or after 100 operations, whichever is the earlier. It is, therefore, necessary to have a simple way in which the reclosers can be removed from the line, preferably without an interruption in supply. A simple and cheap method employing live line technique has been evolved, which allows the units to be removed and replaced under live conditions without any interruption in supply.

A typical example of a three-phase unit installed in this manner is shown in Fig. 6. A single-disc insulator is inserted in the lines and the units are connected to either side using live line taps. A shorting jumper for operation with live line tools is also provided so that the insulator can be shorted out before the units are taken out of service. These jumpers are shown in the parked position. The channel and eye bolt are fixed over the reclosers to facilitate raising and lowering. These units will normally be installed on unearthed lines and therefore, to maintain the impulse level, should not be earthed.

The three-phase recloser is raised and lowered as a complete assembly with its two supporting channels. The normal practice will be to return the complete three-phase assembly back to the workshops for repair and replace it immediately by another overhauled unit. It should be noted, however, that as the recloser consists of three single-phase units, if one unit only is damaged or in need of overhaul, then this unit only will need to be replaced before being re-assembled with the other two overhauled units.

When the authors prepared this article little operational experience of reclosers was available. Until July of this year there had been an abnormal absence of thunderstorms. However, the reclosers have now passed through their first real field test successfully and the results are quoted below.

Whilst it had been hoped to install 60 three-phase sets of reclosers during this summer, capital expenditure restrictions have limited the number so far installed to 27. Up to the end of June, 24 sets had been installed and eight operations recorded. During the period ending 27th July, a further three sets were installed and there was some mild thunderstorm activity giving rise to 16 further operations.

On the night of 27th July, a thunderstorm of exceptional severity was experienced over most of the territory covered by the system referred to in Table I. During the storm there were no fewer than 168 separate incidents due to lightning in the Worcester and District Sub-Area, 13 of which were on the 33 and 66 kV system and 155 on the 11 kV system referred to in Table I, leading to the blowing of 257 11 kV fuses, the operation of 32 11 kV switches, and 24 persistent faults on the 11 kV system.

TABLE II
TYPICAL RANGE OF CO-ORDINATION FOR LIQUID TYPE SLOW BLOWING FUSES AND RECLOSER OF BRITISH MANUFACTURE

Rating of Recloser in Amps	Max. Breaking Cap. of Recloser in Symmetrical Amps	Fuse Rating in Amps	15	25	50
		Range of Co-ordination in Amps			
10	540	Min	115	—	—
		Max	540	—	—
15	800	Min	92	270	—
		Max	660	800	—
30	1600	Min	60	188	425
		Max	605	1230	1600
50	2620	Min	100	125	325
		Max	560	1180	2100
100	2620	Min	200	200	200
		Max	400	1020	1970

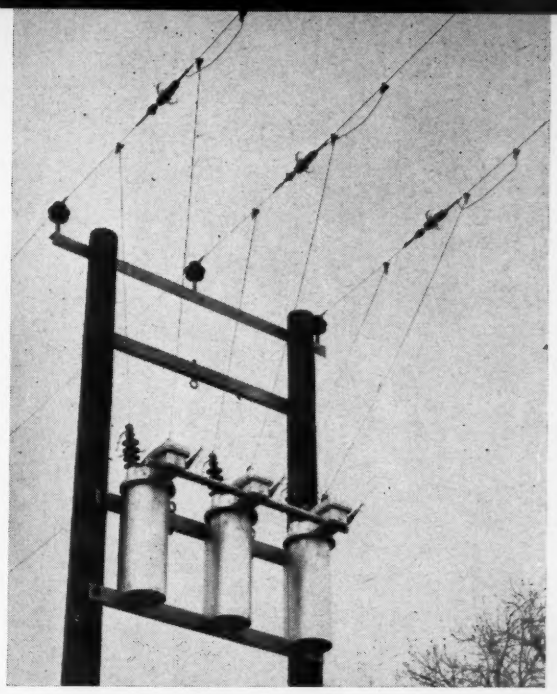


Fig. 6.—Close up of a recloser installation showing the series insulator and shorting jumper for live line removal of a unit without interruption of supply

Nearly all the reclosers in the worst affected areas operated on one or more phases, in fact, 28 phase units situated in twelve different positions recorded between them 66 operations during the storm. None of the reclosers suffered any damage, and all operated on transient faults, no slow blowing fuses operating. The absence of persistent faults appears to substantiate the theory that the rapid interruption of fault currents reduces the likelihood of a persistent fault developing.

The 12 recloser installations which operated during the thunderstorm on 27th July controlled between them 119 miles of overhead line and 339 substations, the reclosers being backed up by 37 sets of slow blowing fuses. One particular installation, near the storm centre, operated nine, eight and seven times on the three phases.

The authors consider that during this one storm the installation of reclosers saved the blowing of some 50 h.v. fuses and confined the interruption of supply to several thousand consumers to one second instead of many hours. Apart from the improved service to the consumers, appreciable saving was achieved by avoiding the necessity of locating and replacing fuses and repairing damage.

Further thunderstorms occurred during August, and 65 more operations were recorded on the reclosers during this month, no slow blowing fuses operating. Except for one unit, which correctly locked out due to a transformer solidly connected to the line being seriously damaged by lightning, all the units operated on transient faults.

The authors would like to record their appreciation to the chairman of the Midlands Electricity Board for permission to publish this article.

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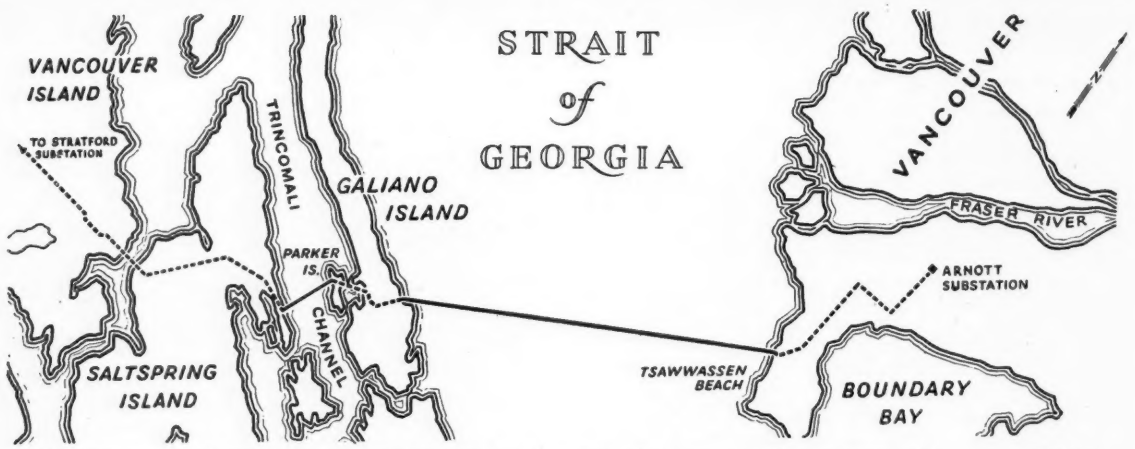


Map showing route of power link between the mainland and Vancouver Island. —— *Submarine power cable.* -------- *Overhead transmission line*

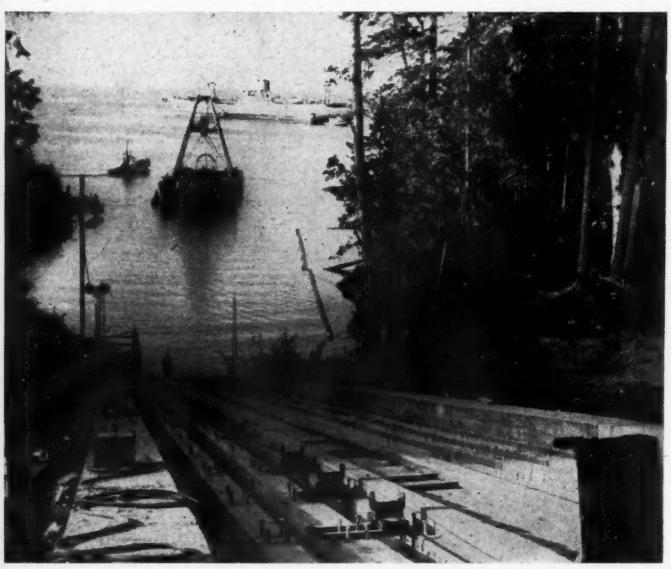
Submarine Power Cable

138 kV LINK WITH VANCOUVER ISLAND

ON Tuesday last the Prime Minister of British Columbia, the Hon. W. A. C. Bennett, officially switched on a bulk supply of electricity from the mainland of British Columbia to Vancouver Island. This ceremony marked the completion of a most satisfactory example of British-Canadian joint enterprise, the organisations concerned being the British Columbia Electric Co., Ltd., and British Insulated Callender's Cables, Ltd. The scheme involves a 48-mile-long 120 MVA, 138 kV 60 c/s cable link from Arnott substation in the delta area of the mainland to Stratford substation on Vancouver Island.

At Arnott substation power is transformed from 230 kV to 138 kV and then conveyed via an overhead route on wooden poles to a point at Tsawwassen Beach, just west of Point Roberts. From here a submarine cable crosses the Strait of Georgia to Galiano Island. An overhead line on steel towers then continues the transmission across Galiano Island, an intervening channel and Parker Island. There is then a second submarine cable to Saltspring Island and finally an overhead line across the Island and another channel to Vancouver Island, where it is linked to the local 132 kV transmission system. Apart from the two submarine cable crossings (16 miles crossing the Strait of Georgia and three miles crossing Trincomali Channel) the other water crossings are quite short and consist of overhead spans of four conductor lines.

A scow approaching the landing site at Galiano Island. In the background is the c.s. Ocean Layer



The operating system envisaged at present is a single three-phase 138 kV link. In the future the Island's power demands may increase sufficiently to require the installation of a duplicate link. The ultimate provision of seven single-core cables has been anticipated, that is, two circuits and one spare cable. It was desirable that some spare cables should be provided for this initial circuit, so the order was placed for the installation of five cables across the Strait of Georgia and four across Trincomali Channel.

The contract, worth about £1 million, was awarded to B.I.C.C. and involved the supply and installation of some 91 miles of high voltage single-core submarine cable of the gas-filled pre-impregnated paper insulated type. Gas-filled cables for use on land are usually operated at 200 lb/sq in, but as the external pressure on the cable would be up to 280 lb/sq in the present cable is operated at 300 lb/sq in. The subjection of parts of the cable to these high pressures made a hard compact form desirable. Furthermore, long lengths had to be made as underwater joints were undesirable and it was required to lay continuous lengths from shore to shore.

As finally produced, the 0·35 sq in conductor consisted of a central spiral steel duct, over which were applied two layers of copper wires and a conducting screen of three impregnated metallised paper tapes. Pre-impregnated paper tapes were applied over the metallised paper screen to form the dielectric, which is itself screened with copper tape. The lead-alloy sheath, extruded to a shrink fit over this core, is reinforced against the internal gas pressure by three layers of tin coated bronze tape, all applied in the same direction. Between this tape and the jute yarn

bedding for the armouring is a protective sheath of vulcanised rubber, capable of withstanding the highest lead sheath voltages liable to occur in service. The cable is armoured with a single layer of galvanised steel wire, applied in a direction opposite to that of the reinforcing tapes to balance torsional forces. The armour is served with two layers of compounded jute yarn and the cable has an overall diameter of about 4in.

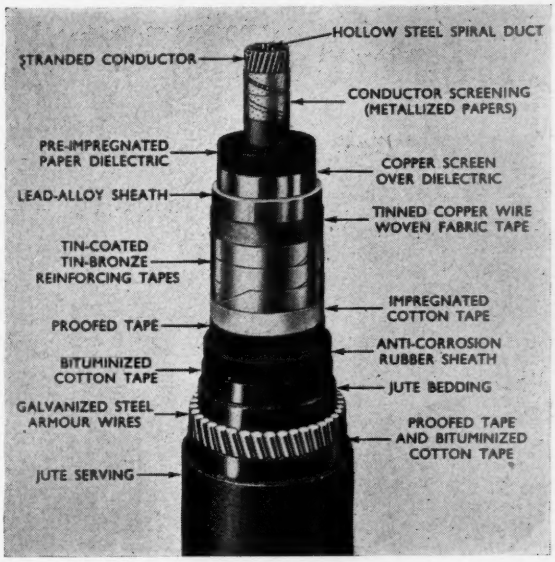
The cable was made in three distinct operations: stranding; insulating and lead sheathing; and, finally, reinforcing, armouring and coiling down. A special manufacturing company, British Insulated Callender's (Submarine Cables), Ltd., was formed to make cable by the above method for this and other major submarine cable projects. A new cable factory was laid out at Trafford Park, Manchester, adjacent to the Manchester Ship Canal, giving the advantage of deep-water berthing facilities. In-line production was most suitable for the manufacture of long, continuous lengths of cable and this necessitated not only many new items of plant but also the considerable modification of standard plant to adapt it for this specialised method of manufacture.

A large coiling-down shed, capable of taking the whole of the cable required for this contract, was constructed between the factory and the Trafford Wharf of Manchester Docks. A gantry, passing over the Trafford Park Road, carried the cable from the factory to the shed and an extension of it carried the cable on to the dockside, directly over the tanks of the cable-ship.

In this design of submarine power cable the main effort was to produce continuous lengths of cable that could be laid from shore to shore without joints. It was always realised, however, that some unforeseen occurrence or damage in the factory or during laying might call for repair work and jointing on the cable. Provision was made for such a contingency by producing a factory joint, suitable for repair of cable damaged during manufacture, and another to effect a repair of a finished cable. The latter joint had to be capable of withstanding the mechanical stresses exerted on it during re-laying, in addition to the continuous electrical and pneumatic stresses imposed upon it in service.

The contract required the cable system to be installed and in operation by the autumn of 1956. Manufacture of the first commercial length commenced in March, 1955, and by March, 1956, several weeks ahead of schedule, the whole 91 miles of finished cable was stored in the coiling-down shed, awaiting transfer to the cableship.

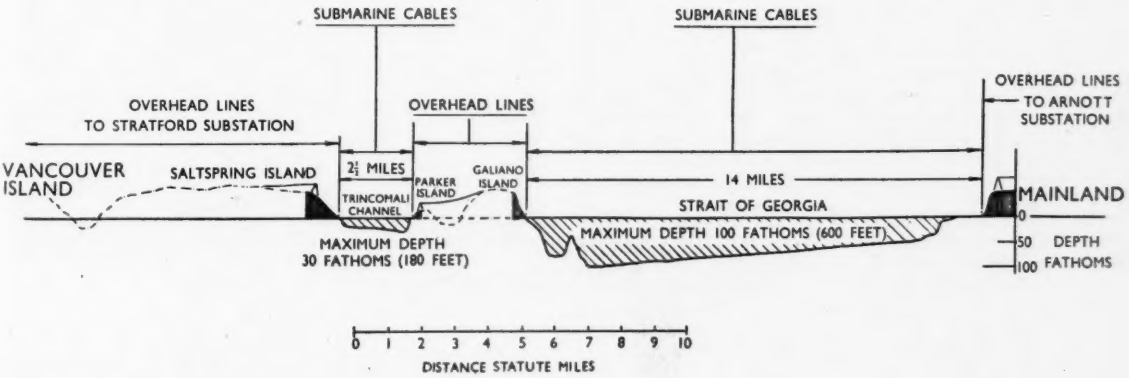
While the manufacture was proceeding, careful consideration was being given to plans for loading, transport and laying of the cables. All these operations were to be the responsibility of the British Insulated Callender's Construction Co., Ltd. To lay the cable the company

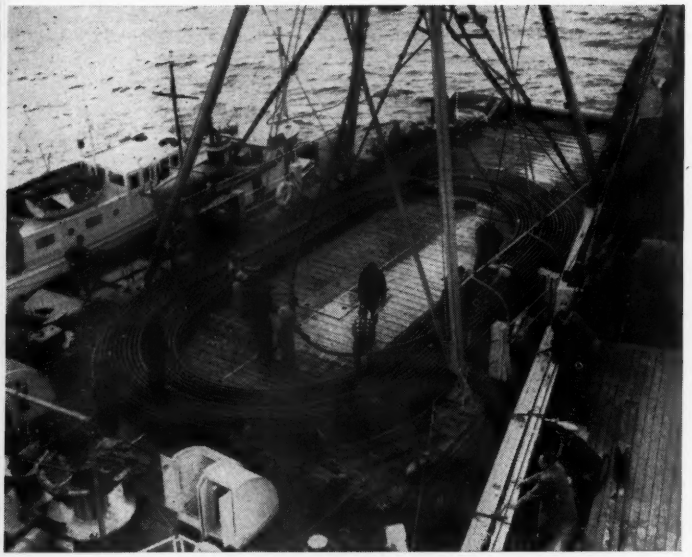


Stepped sample of 138 kV gas pressure submarine power cable

Coiling-down shed containing the whole of the submarine cable valued at £1 million

Diagram of cable route





Cable for landing on Tsawwassen Beach being loaded on to the deck of a scow from the cable ship

chartered the 4,600 ton cableship, *Ocean Layer,* owned by Submarine Cables, Ltd.

A detailed examination of the coastline and a hydrographic survey of the routes between possible landing positions were made for both crossings and four landing points were selected. Conditions at Galiano, Parker and Saltsprings Islands were all similar; steep, tree-lined rocky slopes to the shore, with good, deep water offshore. The landing points selected were small, natural coves giving the easiest possible land approaches. At these landing sites, concrete chases with provision for seven cables were constructed, from low water mark to near the entrances of the sealing end enclosures. From Tsawwassen Beach, the ground rises steeply to a height of 180ft, so a concrete surface cable tunnel, 500ft long, was constructed down the face of the cliff.

To facilitate subsequent identification and recovery for repair the cables of the main crossing were spaced 500 yd apart and those of the shorter crossing 250 yd apart. In view of the probably future additions, the cable positions were planned on a basis of seven cables per crossing. This width made it necessary for there to be considerable differences in length between cables for the same crossing, thus adding considerable complications to the operation.

Cable laying of this kind resolves itself into two distinct parts: laying across the central channel and landing the shore ends. Laying across the channel is carried out by paying the cable out from the moving ship. This is, of course, a normal function of cable-laying ships and this part did not, in fact, present any great difficulties. It was desired that the cable should lie straight on the sea bed, without appreciable tension, yet without loops, and a method of laying was evolved whereby the tension was applied to the cable according to a previously calculated schedule depending on the depth at the point of laying. This schedule was based on a nominal laying speed of three knots.

For the laying of the shore ends it was necessary for the ship to be stationary and to have some arrangement for landing the cable ends. The three landing sites at Galiano, Parker and Saltspring Islands presented no great difficulties. The shore at Tsawwassen Beach was very different, being similar to that on the French coast from Calais to Cap Gris Nez. The extremely shallow water so far offshore meant that an alternative to barrelling had to be found. The method adopted was to coil the requisite amount of cable (3,000 yd) on to the deck of a flat-bottomed scow and to lay cable while towing it inshore. When close in, the vessel was moored and the end pulled ashore.

After each cable had been laid, a high-voltage d.c. test was carried out on the cable at atmospheric pressure. The cables were then moved into their final positions in the chases and the ends terminated in sealing ends. They were then gassed and the official h.v. acceptance test carried out, together with other electrical tests and a pneumatic test to ensure gas tightness. To prevent damage to the cables, malleable iron protectors were fitted to the cable at the shore end of the concrete chases to below low water mark at the three deep water landings. At Tsawwassen Beach, the protectors were fitted for a short distance from the tunnel entrance, the remainder of the shoreward end of the cable being buried in trenches. All the cables were made alive in turn and the first trial transmission of power to Vancouver Island took place in late August.

THE BRUSSELS 1958 EXHIBITION

MUCH importance is attached by leaders of the British electrical industry to the World Exhibition which is being held in Brussels from 17th April to 19th October, 1958. In a message to all members of the British Electrical and Allied Manufacturers' Association, Lord Chandos, president of the Association, says that the Brussels display will provide an opportunity to the British electrical industry to demonstrate to the world its past achievements and its determination to remain in the forefront of industrial development.

The B.E.A.M.A. Council has authorised participation in the British Industrial Pavilion in Brussels, stipulating that the exhibit must be worthy of the industry. To ensure this the industry must provide sufficient financial support and Lord Chandos calls for generous contributions from B.E.A.M.A. members.

The British area in the exhibition, for which the Government will be responsible, will be about 5 acres, comparing favourably in size with the areas taken by other leading industrial nations, including the United States, Russia, Germany, France, Holland, Italy, Switzerland, Czechoslovakia and Canada. Apart from an official pavilion, there will be a much larger British Industrial Pavilion and other features, the organisation of which is in the hands of British Overseas Fairs, Ltd., on behalf of the Federation of British Industries.

Altogether 53 nations are supporting the Exhibition and during the six months that it will be open Brussels will be the centre of all kinds of international congresses and meetings. It is expected that the Exhibition will be visited by over 30 million people including trade and diplomatic missions from all countries.

The B.E.A.M.A. collective exhibit in the Power and Energy Section of the British Industrial Pavilion, occupying 5,000 sq ft, will portray all aspects of the British electrical and allied manufacturing industries. The Design Research Unit has prepared preliminary plans and designs for the proposed exhibit. It is hoped that makers will co-operate in lending models and other suitable exhibits. The display is planned to cover the full range of the generation, transmission and use of electricity, from heavy plant to the smallest accessory.

Firms and associations giving financial support to the project will be afforded special facilities at the Exhibition and their names will be listed in the official literature.

Thoughts on Street Lighting

Responsibility of Local Authorities

By D. WINTON THORPE, M.I.E.E.

STREET lighting is not an end in itself; too many people, I fear, think that it is. In fact it is, like every other public service, a means to an end—a means to several ends. It is also a commodity which has to be bought. It has to be bought and maintained by ratepayers, so that what is "efficiency" to the lighting engineer is not necessarily "overall efficiency" in the eyes of the local authority who are the elected agents of the ratepayer.

If a main street (Class 1) is to be relighted, the basement dweller in a poorly-lighted mean street is called on for his contribution even though he may never set foot in the main street. Street lighting cannot be divorced from social economics. It is not put there solely for the motorist.

In 1415 the Mayor of London was so worried about crime and natural hazards of the city by night that he ordered all householders to "hang out lanthorns" during winter evenings from All Hallows to Candlemas—from the end of October to the beginning of February—as security against thieves and for the convenience of foot passengers. This was probably the first time that street lighting was made a responsibility of "the inhabitants at large," a pretty phrase which is still used in legal documents relating to local government activities.

To-day there is really very little basic difference in the purpose of street lighting. The motorist sometimes likes to think that the highways should be lighted for his convenience only, though the foot passenger and the cyclist have an even greater stake in the convenience offered by good lighting. The suppression of crime, from the smash-and-grab raid to less serious breaches of the peace, is also dependent, as it was in 1415, on good lighting.

Many Conflicting Views

Municipal lighting is a subject which, perhaps, produces more disagreement and more didactic opinions than any of the other matters to which a borough council must give its attention. There are so many points of view, all in their way reasonable, that a borough works or highways committee may find it requires a Judgment of Solomon to produce the right answer. Even the motorists cannot agree whether they prefer mercury to sodium lighting or *vice versa*, while the ladies (who, after all, pay rates directly or indirectly) know that they look ghastly in either of the two.

The members of the committee are torn between a system which is cheap to install but expensive to maintain, and a system with heavy first cost but lower maintenance charges. Add to this the fantastic number of other authorities such as police, ambulance service, public transport, etc., who have a real interest in street lighting and who must all be consulted before a decision is made, and it seems amazing that any decision at all can be reached.

Even when the method and intensity of the lighting has been decided upon to the satisfaction of the majority—perhaps it would be better to say, to the least dissatisfaction of all—there still remains the design of the lamp standards and lanterns, a matter about which, of course, every single person who uses the road has strong unshakable views.

An example of the feeling which can be aroused may be found in a new double carriageway arterial road which is in process of being built by the London County Council through my own borough. Borough councillors are being assailed from every direction by ratepayers who anathematise the lighting standards, the lanterns, the method of lighting (mercury vapour) and the spacing. This would seem to suggest that the whole conception was wrong from start to finish were it not for the fact that no two complainants agree. In fact, the borough council have had no say in the matter as the L.C.C. have built the road under statutory powers from Parliament. Personally, I like everything to do with the method, spacing and design; so I only add to the confusion.

This is, of course, an exceptional type of highway which is built by and paid for by the "gods" (who exact their toll vicariously from the ratepayers), though it is handed over to the borough for maintenance. It is inevitable in such a case that "the inhabitants at large" cannot choose their own "lanthorns" but must nevertheless keep the wicks trimmed in the common interest.

To a certain degree this shared responsibility for the installation of street lighting—where, for instance, the Ministry bears a large proportion of the capital cost—does tend towards a national standard; but it is only a tendency. The motorist can still find himself plunging from high intensity sodium lighting into the comparative blackness of filament lighting for no better reason than that he has crossed a borough boundary.

Mr. Winton Thorpe is a member of the Hammersmith Borough Council

Now, although a borough may get a substantial Treasury grant for the installation of street lighting, the maintenance remains its own responsibility and several categories of borough ratepayers can work up a reasonable grouse if main street lighting is the wrong colour or is too expensive. So, then, it appears that the selling of street lighting is not just a question of lumens and lamberts, of direction and diffusion. It becomes the much more difficult task of providing for the whims and the set ideas of dozens of classes of people with conflicting interests.

Perhaps unfortunately for the lighting salesman he usually has only one ostensible buyer to deal with in any borough—the borough engineer. Unless the lighting designers can produce a panacea for all the ills complained of by such a variety of users, it is the borough engineer who must in the first instance marshal, analyse and collate the relevant features of various systems and present a selection of them to the Works or Highways Committee, much as a judge sums up to a jury. From the salesman's point of view it must be exasperating not to be able to come to grips with the real buyers, the committee, or even better with the real customers, the ratepayers. All he can do is to argue his case as it were before a judge in chambers and hope that the judge will present his case—together with several competitive cases—fairly to the jury who in turn have to decide, not what they like but what they think the majority of their ratepayers will like.

Thank goodness the committee's decision will almost

certainly receive an immediate acceptance by the council, who in my experience rarely even debate, much less disapprove, a technical recommendation of this sort from the appropriate committee. If forty or fifty worthies started to argue about street lighting a council session would last all night. For my own part, I think that a substantial sub-committee should visit the A.P.L.E. conference every year *at the expense of the ratepayers*. This might save the latter money in the long run.

Street lighting, as we know, is now a highly developed science and while it would be impossible, even if it were desirable, to ensure that all members of a Works or Highways Committee were expert in the subject, it might be worth an effort to teach them sufficient of the science to make them take what I will term a table interest instead of merely an armchair interest. Usually the only person present at the committee's deliberations who understands the technical problems is the borough engineer, and while he is usually competent and just in his explanations to the committee he dare not elaborate the finer points since they would not be understood. Moreover, the borough engineer must be knowledgeable on so many branches of the council's activities—road surfaces, county council and Ministry regulations, sewers, refuse disposal, etc.—that he cannot, unless he is a superman (and many of them come near to deserving the description), pass on to his committee all the technical arguments which are the stock-in-trade of the lighting salesman.

Is there perhaps a case here for requiring the borough engineer to produce a short list of competitive salesmen who could be given an opportunity of meeting the committee in session? After all, this is what happens in the case of an applicant for employment who may be going to cost the ratepayers only £700 a year. Such a procedure would make a tedious addition to the work of councillors, but I believe they might welcome it as a means of bringing them a little closer to the problem. It may be argued that if lighting is to be treated in this way, then why not sewers and road paving. The answer, I think, is that while most of the responsibilities of the borough engineer are purely technical and have relatively little apparent impact on the ratepayers' senses, street lighting starts as a technical problem but emerges into a visible social amenity with virtues or failings which are continually in evidence.

It is perhaps worth remembering that there are nearly 2,000 councils of all sorts (county, borough, urban, rural, etc.) in Great Britain and that each will have a Works or Highways Committee or its equivalent. In other words there are many thousands of amateur local lawgivers who in an average year will between them recommend the expenditure of several million pounds on street lighting; and all they understand about the subject—except for a few who may be expert—is what their borough engineer tells them.

With the advent of electricity into the field of street lighting no radical change in the design of street lighting schemes became necessary. Indeed, it would surprise many to know how much gas lighting still persists in our streets. But with the advance of technical science, the mercury vapour, the sodium and the fluorescent lamps have introduced a new set of standards and a new conception of the economics of street lighting. This progress will continue, and though the " inhabitants at large " who must foot the bill can hardly be expected to master the intricacies of the science, I feel that it should not prove impossible to bring a certain amount of enlightenment to the thousands of members of Works and Highways Committees.

The work of a conscientious councillor is very exacting and he doesn't take on the job for fun. He usually wants to make himself acquainted with every detail of the administration of his authority, yet I think I should be right in saying that, while most of them know the various types of street paving available and their respective merits, none of them knows what a lumen is.

PUBLIC LIGHTING CONFERENCE

PROCEEDINGS AT BLACKPOOL

WHEN we arrived at Blackpool on Monday evening last week for the annual conference of the Association of Public Lighting Engineers which was to begin the following morning we found that many of the expected 1,200 or so delegates had already arrived.

Our first glimpse of the Blackpool illuminations was a little disappointing, but we were soon relieved to see how the lighting and particularly the colouring were brightened up in a rather exciting manner by the lifting of a slight sea mist.

The Conference was opened in the Empress Ballroom, Winter Gardens, on Tuesday morning by the Deputy Mayor of Blackpool, Councillor D. J. Johnson.

The retiring president, Mr. J. M. Waldram, then introduced the president for 1956-57, Mr. H. Carpenter, illuminations and public street lighting officer, Blackpool. Referring to the need for " lighting artists " who had both æsthetic and technical qualifications, Mr. Waldram said that the illuminations at Blackpool were evidence of the new president's skill both as a lighting engineer and as a " lighting caricaturist."

After being invested with the presidential chain of office, the president introduced the new vice-president of the Association, Mr. N. Axford, Plymouth District Manager of the South Western Electricity Board. Mr. Carpenter then delivered his presidential address which, with three of the papers, was summarised in our last issue.

At the conclusion of the morning session, the Deputy Mayor of Blackpool, in company with the president, opened and inspected an exhibition of street lighting apparatus and equipment in the Winter Gardens, and outdoor displays of lamp columns and mobile equipment in the Middle Walk Promenade.

When the Conference resumed on Tuesday afternoon, Mr. H. W. Cumming, B.Sc., A.R.I.C., of the Siemens-Ediswan Research Laboratories, introduced his paper entitled " Light Sources—New Developments and Trends." The actual presentation took the form of a series of demonstrations of light sources in two broad fields—those in which electrical energy was converted into light by raising the temperature of the lighting material to incandescence, and those in which the conversion took place by the creation of a state of unbalance in gaseous material.

In the discussion on the paper, Mr. E. H. Nelson (G.E.C. Research Laboratories) said he was surprised that there was no mention by the author of the very intensive development work which was now going on all over the world to find a substitute for tungsten. Recent work in solid physics gave hope that there might be a material which could be used in place of tungsten. The prize was worth striving for—say, 40 l/W, excellent colour, high brightness and no operating gear. It might be that the incandescent lamp would shoulder the discharge lamp off the market yet.

There had been a great spurt of development in the high-pressure mercury lamp, chiefly by the use of the three new phosphors mentioned in the paper, but he wished to correct the impression that these new phosphors only employed the long wave ultra-violet radiation; in fact, they employed both long and short wave ultra-violet radiation. Hence the superiority of quartz over glass; glass would never rival quartz for colour correction.

Mr. Howard Long (Benjamin Electric Co., Ltd.) looked upon the fluorescent bulb lamp as the lamp of the future, particularly for street lighting and industry. The fluorescent tube was a very useful tool, but the bulb gave much more output, it could be mounted high up and could be used with a much more practical fitting.

Mr. J. Wilson (Paisley) said that no technician had yet shown how the great waste of heat in electric light sources could be reduced.

Dr. Ing. N. A. Halbertsma (Roads Department, Netherlands Ministry of Transport) said that modern lamps with a life of 4,000 or 5,000 hours were a great contribution to the economic problem. The modern colour-corrected high power mercury vapour lamp, which had been much improved recently, still had the serious drawback that the fall in light output during its life was larger than that which had been admitted in the case of the incandescent lamp.

Dr. H. H. Ballin (Thorn Electrical Industries) said that the new reflector tube to which the author referred would have a tremendous application in many fields, including street lighting. There had recently been a very substantial increase in efficiency in the field of fluorescent lighting, and this had strengthened the economic case for its use, at least in certain applications.

Mr. H. M. Ferguson (G.E.C. Research Laboratories) said that for special applications the lamp designer was at great pains to ensure that the lamp should not only have a high efficiency and suitable colour, but should also have the right shape and form to make the best of the optical system in which it was to be used. For more general applications and in particular for street lighting they tended to assume that the lamp with the highest efficiency was the most suitable and they did not perhaps attach sufficient importance to the shape of the source.

Mr. C. Hughes (Siemens) said that the reduction of bulb sizes by the lamp makers was creating a problem for the lighting engineer, and many users were much concerned about how far that process was going.

Mr. F. H. Pulvermacher (South Wales Electricity Board) said that, thanks to the longer life of lamps of the gaseous type, his authority had been able during the past six years to keep its electricity supply and maintenance charges constant and even to reduce them.

At the civic reception: the Deputy Mayor and Mrs. Johnson greet the president and Mrs. Carpenter

Mr. H. W. Cumming, in a brief reply to the discussion, said that the research laboratories in this country were giving considerable attention to the maintenance point raised by Dr. Halbertsma in connection with colour-corrected mercury vapour lamps. If reference to the work to find a substitute for tungsten had been omitted from the paper it was because it did not in the immediate future offer a promise of a worth-while light source. He agreed with Mr. Ferguson that the form and shape of a light source must be considered in association with its luminous efficiency, and it was precisely on such points that there must be co-operation between the lighting engineer and the lamp maker.

On the motion of Mr. E. C. Lennox (North Eastern Electricity Board), a vote of thanks was accorded to Mr. Cumming.

On Tuesday evening there was a civic reception by Mr. and Mrs. Johnson, supported by Mr. and Mrs. Carpenter, which was followed by dancing.

Wednesday morning was devoted to an inspection of the exhibitions of street lighting equipment, indoors at the Winter Gardens and outdoors at the Middle Walk Promenade, both of which were surveyed in the *Electrical Review* last week. The only comments we can usefully add, we think, are that the attendance was really good, and that great interest was evident; that to fully appreciate the advances made during the past year in development demands more time than a morning's " session " affords; and that lighting columns aligned along a stretch of promenade make a far better display than a cluster of columns on a lawn such as we saw at Folkestone last year.

Annual Luncheon

Following a short break after inspecting the exhibition, the delegates and visitors assembled at the Spanish Hall for the annual luncheon of the Association at which Mr. Carpenter took the chair and Mr. J. Eccles, deputy chairman, Central Electricity Authority, was the guest of honour.

At this function Mr. N. Axford, B.Sc., M.I.E.E., vice-president, proposed the toast of " The County Borough of Blackpool and the Guests," to which the Deputy Mayor of Blackpool responded.

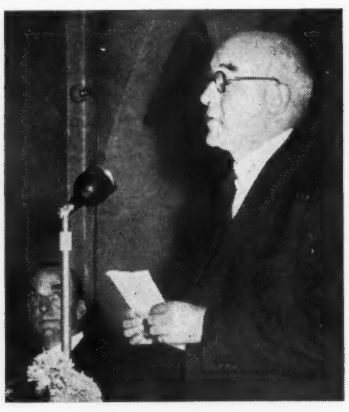
Mr. J. Eccles, in proposing the toast of the Association, said that unfortunately public lighting was one of the

silent public services which people gladly accepted, although few stopped to ponder the technical and economic problems associated with it. Indeed, it might be said that the public were only conscious of its existence when it was absent. Nor did the public appreciate the technology that went into the provision of public lighting without glare, or the great strides that had been made in providing more light at lower energy consumption.

The record of public lighting engineers in the reduction of road casualties, although not capable of precise calculation, must be an outstanding one. He thought that they might contribute as much to the preservation of human life as did the largest hospital in the kingdom.

Two great problems facing this country at present were the necessity to live together and to co-operate for the common good, and our ability to sell our products in the markets of the world. Public lighting engineers were already doing all they could to foster good human relations. Although they were not directly concerned with the export business, they could and should do all in their power to grant facilities for experiment by manufacturers so that the latter could produce more efficient goods at less cost in materials and so win markets abroad.

Great strides were being made along those lines in the generation of electricity. After the second world war, a 30 MW turbo-alternator was a standard product. To-day, they were designing and constructing units for an output of 200 MW. Not only did those new units give more electricity per ton of coal burned, but they represented a substantial contribution to the better utilisation of materials. The amount of copper per MW in a 200 MW set was only 22½ per cent of the copper per MW in a 30 MW set. No doubt public lighting engineers could do something similar in the very special materials which they used in their lamps and fittings.



Mr. J. Eccles proposing the toast of the Association at the annual luncheon

Another way in which they could make a substantial contribution to our international payments was by attracting more visitors to this country by such display lighting as was to be seen in Blackpool.

Mr. H. Carpenter, responding to the toast, said that the Association could not be more sincere in its aim to further the progress of public lighting, or more earnest in its endeavours to improve the public service which its members supported and administered. The increasing membership showed that the Association was a lively and thriving one, with important work to do, and this year's conference had broken all attendance records.

On Wednesday afternoon there was a film show—lighting films the programme said, but it was a little difficult to detect any connection with public lighting in the gas film "The Industrious Flame."

"Out of the Dark" traced the development of artificial lighting from the earliest times and "Electricity and Light" explained the principles of arc, filament and fluorescent lighting.

Practically everyone attending the conference turned up for the tour of inspection of the Blackpool illuminations on Wednesday evening and all were impressed by this really stupendous effort.

Thursday morning saw the delegates in good heart, not only because of the undoubted success of the conference, but also because of the promise of another fine day—the fourth in succession.

Lantern Design

The morning session was devoted to the presentation of the paper "The Development of Lantern Design," by Messrs. J. G. Holmes and W. T. Souter, mainly in the form of a display of lantern slides.

Mr. H. E. G. Watts (A.E.I. Lamp & Lighting Co., Ltd.) said that he detected a dangerous downward trend towards a reduction in the quality—both durability and optical performance—of street-lighting equipment, as a result of the present emphasis on the policy of accepting the lowest priced tenders. This could easily lead to a paring down of equipment and if the tendency was not carefully watched it might result in expensive maintenance and patchy and dangerous lighting. He agreed with the authors that it was worth making an attempt to specify photometric performance more closely.

Mr. F. H. Pulvermacher (South Wales Electricity Board) thought it was a pity that there should be such a large variety of lanterns to meet the four elemental tasks of (1) lighting a straight road, (2) lighting a curved road, (3) suitability for a height of 15ft, and (4) suitability for a height of 25ft.

Mr. A. G. Penny (G.E.C.) supported the authors' plea for more experimentation in street lighting. It was a fallacy to say that it was only a matter of finding the money. Our roads were changing, and would change radically as more money was spent on modernising them. The traffic densities were changing and theories about road brightness needed reconsideration. On virtually all modern British roads lighting was based upon road brightness, but with the present traffic density it was often impossible to see the road. Moreover, the public's attitude towards road safety was changing, and he believed there was a greater will to spend money to make the roads safer.

Dr. Ing. N. A. Halbertsma urged the manufacturers of fittings to give more study to the use of two lamps in one lantern. By this means, the whole problem of after-midnight lighting could be solved, by the use of only one-half or, where there was three-phase working, one-third, of the unit. Another advantage was that whenever a lamp broke down there was not a complete outage.

Mr. R. Stevens (Thorn Electrical Industries) said that the standard of lantern construction in this country was of a very high order, and he considered that the A.P.L.E. exhibition had a great deal to do with this. The big factor at present was cost, which entered into all the other factors involved in designing a lantern.

Mr. S. S. Beggs (G.E.C.) made two pleas. The first was primarily directed to public lighting engineers and was connected with the use of the equipment. The fittings designer put much effort and trouble into his design, but the result could be seriously affected and often spoiled entirely by careless use. His second plea was to the administrators not necessarily to regard the cheapest equipment as the most economic.

Mr. C. Bicknell (Siemens) supported those speakers who had stressed that insistence on acceptance of the lowest priced tenders would inevitably bring a reduction in quality and performance and an increase in maintenance costs.

Mr. J. R. Brodie (Ayr) said that if the manufacturers

imagined for one moment that the local authorities in this country would fall in with the idea of accepting any but the lowest tenders they were living in a fool's paradise. In local authority development work the cost had to be spread over twenty years, and they could not afford to buy new lanterns before the old ones had been paid for.

Mr. G. W. A. Illingworth (Southport) said that there was a tendency to forget the maintenance man. He suggested that the proper way for a designer to test a lantern was to put it under a shower of water, then try to open the lantern, clean it, and close it again.

Mr. L. R. Osgood (Luton) said that from the maintenance point of view the designers had already made a great contribution; even in the most inclement weather, the maintenance man could now get at the job.

Mr. R. B. Steventon (Cannock U.D.C.) made a plea for more standardisation of equipment which could only come from experiment which should be done on a national basis and not by individual manufacturers.

Mr. U. G. Allender (Camberwell) urged the Association to collect and circulate to local councils information on experiments in new lighting projects in various parts of the country. It would help councillors if, when they had to decide whether or not to accept the lowest tender, they could go to some place and see a street which had been lit with the latest design of equipment.

Mr. W. T. Souter, in reply to the discussion, said it was clear from the various comments that had been made that the lantern was a factor of paramount importance in lighting traffic routes and other roads, and that improvements in lamps should be matched by advances in lantern performance if street lighting was to be improved. The element of competitive performance, with its associated research, had been responsible for the present standard of street lighting as represented by the current B.S. Code of Practice, but while there was every justification for satisfaction with the contribution which these standards were making to road safety and the prestige of British street-lighting equipment overseas, little improvement had been made in recent years in regard to the performance requirements of Group A installations.

On the motion of Mr. J. M. Ward (Member of Council) a vote of thanks was accorded to the authors of the paper.

Discussion on Mr. C. C. Smith's Paper

At the afternoon session on Thursday a paper by Mr. C. C. Smith, M.I.E.E., F.I.E.S. (Liverpool), on " Street Lighting in Great Britain, Past, Present and Future " was presented and discussed. This paper was reported in our last issue.

Opening the discussion, Mr. G. W. A. Illingworth (Southport) said that an important factor to be taken into account from the point of view of the motorist was the multiplicity of light sources. In a sodium installation the motorist entered the road with the knowledge that everything which concerned his safety and that of the pedestrian would be illuminated or silhouetted by amber light, with the exception of the traffic signals. In a mercury vapour or tungsten or gas installation he had to differentiate between street lighting and lighting from houses, shop windows, etc., which in some cases might appear to belong to the street-lighting system and thus mislead him as to the direction or distance.

Dr. H. H. Ballin (Thorn Electrical Industries) referred to what he called the justifiable moan of the manufacturers of equipment that the idea of the lowest price would always cause a certain delay in development. In this matter public lighting engineers and their councils could assist by giving manufacturers more information than was at present available to them. He suggested that it might be possible to choose some of the danger spots in this country and use them as experimental areas.

Common Councilman Douglas Young (London) referred to the need for better pedestrian subway lighting, and described the glare-free improvement in the illumination of the Cannon Street and Mansion House Station subways. The result had been that many more pedestrians found pleasure in using those subways, to the betterment of their personal safety and the flow of vehicular traffic.

Mr. B. S. Ossitt (South Eastern Electricity Board) made a plea that, until legislation was introduced to reduce the number of lighting authorities, the small lighting authorities should receive from the Ministries concerned a fair consideration of their requests and a fair proportion of the monies available.

Mr. C. Bicknell (Siemens) said that he knew of an instance where the radio control system of one town played havoc with the lighting in another town. It seemed to him that absolute chaos would result unless there was an arrangement for every lighting authority to switch on and switch off its lights at the same respective times.

Dr. Ing. N. A. Halbertsma said that the plans now being discussed for urban expressways were long-term plans which would cost an enormous amount of money. He suggested that the main roads running through cities and connecting different trunk roads could be made into a kind of urban expressways if they were provided with the necessary lighting, which meant certainly 5 lumens per square foot.

Lieut.-Comdr. E. J. Cook (North Western Electricity Board) said that the time had arrived for representations to be made to the Ministry of Transport and the Government for money to be set aside for lighting experiments which would line up with the large capital sum that was to be spent on the new main roads.

Mr. J. R. Brodie (Ayr) said that if public lighting were regionalised or a system of amalgamation adopted whereby urban district councils were put into areas similar to the police and fire services, they would immediately lose their local powers and their individuality. But he maintained that the three services—police, fire and public lighting—should be treated together.

Mr. G. K. Lambert (B.T.H.) said that the Road Research Laboratory had produced data showing that certain surfaces were very much better from the reflection point of view than others, while being equally good in other respects.

Mr. G. Berry (Coventry) remarked that the level of illumination that we worked to in this country to-day in public lighting was probably about the same as it was twenty years ago, whereas the level of illumination in schools and public buildings was probably three times what it had been then. He had also found in Holland that fluorescent lighting, apart from cases of decorative lighting, was on the way out.

Mr. E. H. Jesty (London Electricity Board), referring to the author's indication of increased mounting heights and the attendant advantages of improved illumination and decreased glare, said that another advantage was comparative freedom from malicious damage. Mr. Jesty also said that Mr. Smith's historical paper reminded him of a topical note in the *Electrical Review* of 24th August in which comments by the electrical engineer of Blackpool in 1896 on the poor condition of the lighting cables were requoted. " We are glad to know that the situation to-day is very different," said Mr. Jesty.

Mr. A. Pryce-Jones (Brighton), in closing the discussion and moving a vote of thanks to the author, said that he was beginning to hope that some improved method of producing the light would in due course relieve them of the

present horrors of sodium and mercury by night and of fluorescent fittings by day.

On Thursday evening there was a reception at the Spanish Hall by the president and Mrs. Carpenter.

The Continental Trend

At the closing session on Friday a paper "The Continental (Europe) Trend of Public Lighting" was presented by Professor Dr. Ing. N. A. Halbertsma (Adviser to the Netherlands Government on Road Lighting), who referred to fluorescence as having made white light available from the mercury discharge in two ways without reducing its efficiency. Low-pressure discharge produced largely ultra-violet radiation, which was transformed by fluorescence into visible light of any hue of white, as in the tubular lamp. With the high-pressure discharge, fluorescence only corrected the colour by adding red and pink. The tubular lamp was a large-sized source and gave a small flux of light and was therefore of low brightness, whereas the colour-corrected lamp was a source of small size and large flux and therefore of high brightness.

Dr. Ing. N. A. Halbertsma

The trend of public lighting on the Continent appeared to be influenced by the earlier arrival of the high-pressure type. Great Britain took the lead in the application of the tubular fluorescent lamp, which made possible either a reduction in energy consumption or a raising of the level of illumination. Aesthetic problems probably were less difficult on the Continent, where lamps were normally 4ft long for 40 W, as against 5ft for 80 W in Britain, and where the columns had a mounting height of 30ft compared with 25ft. In the Netherlands lines of fluorescent lamps were often suspended across the street to provide a broad band of uniform brightness in wet weather.

The new colour-corrected mercury lamps (80 to 400 W) provided a considerable extension of the range of fluorescent light sources. They resembled incandescent lamps with a more elongated bulb, though the dimensions were somewhat smaller. A considerable number had been installed in Spain, France, Belgium and the Netherlands.

Had colour-corrected lamps been produced, say, five years before tubular fluorescent lamps for public lighting they would largely have replaced incandescent lamps from 100 to 1,000 W because of higher efficiency; medium-pressure mercury lamps because of more agreeable colour; all combinations of blended light, because the white light could be obtained in a simpler, more efficient way (40 l/W compared with 20 to 25 l/W) and mirror reflectors and refractors could be used. Tubular fluorescent lamps would have been welcomed in 20 W units in 2ft lengths for economy and would have replaced in due course all incandescent street lamps of 40, 60 and 75 W.

Sodium lamps would hold their place in public lighting not only because of their luminous efficiency (twice that of mercury) but also because of the good visibility they provided. In the Netherlands and in Belgium roads leading into a town were often provided with sodium lights up to and including the outer circular boulevard, thus keeping much of the through traffic out of the centre of the town.

In Belgium local authorities were responsible for the lighting of State highways in their territory, but the Ministry of Works could grant a subsidy up to 30 per cent of the cost of the installations. In Switzerland neither the Governments of the Federation or of the Cantons could interfere with the municipalities in regard to highway lighting, but the Canton of Zürich had prepared a plan for lighting all main roads by sodium by degrees after negotiations had been completed. In Germany the municipalities extended their public lighting systems to the roads connecting cities with the autobahns. The Netherlands was believed to be the only country on the Continent where a Ministry had attempted to co-ordinate the lighting projects of the State highways. In 1939 it was decided that all roads carrying traffic of over 2,400 vehicles a day should be equipped with sodium lighting (6 kW/mile) to permit the use of side lights only; of the original programme of 80 miles, 50 were now thus lighted. On all roads with four or more traffic lines two 85 W sodium lamps would be supported on every 30ft column spaced at 85 to 95ft (13 kW/mile). It was claimed that neither kind of fluorescent lamp could rival the sodium lamp using cut-off reflectors in regard to economy, low glare discomfort, as a colour guide for through traffic, and visibility even in fog.

Discussion

Opening the discussion on this paper, Mr. E. H. Jesty referred to the possible future trend towards colour-corrected mercury vapour for main thoroughfares and squares. He said that the present Continental trend towards large numbers of low wattage lamps in one lantern was certainly one of which he saw no evidence in this country. It appeared that one aspect of the Continental trend was greater mounting heights than were favoured in this country. In Paris, for instance, columns of 55ft and 43ft mounting height existed, and the aid of the fire service had to be enlisted when lantern maintenance was needed. Was this economical?

M. L. Gaymard (Electricité de France) showed some slides of lighting installations in France, and pointed out that the high columns which were necessary in some cases were very expensive to maintain.

Mr. B. C. Ossitt (South Eastern Electricity Board) said that in cases where fluorescent lamp installations were used with their axes parallel to the street, the installation must be generously placed. He showed some slides of public lighting installations in Moscow where, generally speaking, tungsten lighting was the only form used.

Mr. Howard Long (Benjamin Electric) said that Dr. Halbertsma had given much evidence that street lighting was moving towards the technique of industrial lighting.

M. A. Boereboom (Ministry of Public Works, Belgium) suggested that the A.P.L.E. should make a comparative study of the legislation on street lighting in various countries, with particular reference to uniformity of lighting and the safeguarding of local powers and individuality.

Mr. C. Harper (Barking) said that Dr. Halbertsma had confirmed the importance of road surfaces in regard to public lighting and the vital importance of co-operation between the public lighting engineer and the municipal engineer.

Mr. J. M. Waldram, B.Sc. (G.E.C.), said that, in spite of the differences caused by local circumstances, it was clear that the principles upon which public lighting engineers worked were the same in the various countries. It was, for instance, clear that if the possibilities of reflection from road surfaces were not exploited to the full, it was necessary to be generous in some other way, such as spacing.

Mr. L. R. Osgood (Luton) said that where high mountings had been necessary in this country, a winch system for winding down the lamp to ground level was sometimes employed.

Mr. J. C. Cotton (Portsmouth) said that the use of colour-tracked traffic mentioned by Dr. Halbertsma was

not a new idea. In Portsmouth they were connecting main traffic routes to Group A sodium and the secondary local through routes to Group B sodium, with the idea of suggesting to motorists a pre-determined route at night.

Mr. K. T. O. Cox (Blackpool) said there was in Paris a telescopic lighting column having an electric motor which enabled the column itself to be lowered.

Mr. F. H. Pulvermacher stressed the need for greater liaison between public lighting engineers on the Continent and those in this country.

Mr. A. W. Gostt (Phillips Electrical) said that in this country we had to some extent lost the pioneering spirit of the early 'thirties in the public lighting field. It was no use leaving the experimental work to the lamp and equipment makers only—the co-operation of the authorities was needed in greater measure.

Mr. N. Boydell (South Eastern Electricity Board), who moved a vote of thanks to Dr. Halbertsma, said that the paper gave evidence of how progressive, imaginative and sensitive to æsthetic values public lighting on the Continent was compared with those values in this country.

At the conclusion of the session, the President announced that next year's conference would be held in Torquay from 17th to 20th September, 1957.

A vote of thanks to the President, moved by Mr. J. M. Waldram and seconded by Mr. E. Howard, was carried with acclamation. The Deputy Mayor of Blackpool (Councillor D. Johnson) then closed the Conference.

House Heating Conference

REPRESENTATIVES of the Press, including many women, were present at a conference arranged for the British Electrical and Allied Manufacturers' Association by Editorial Services, Ltd., which was held in London last week. The purpose was to introduce the subject of house-warming during the coming winter. Mr. Claude Simmonds (Editorial Services) presided and introduced the two speakers.

The first was Mr. Raymond Berry (Berry's Electric), representing the Domestic Electrical Appliances Section of B.E.A.M.A. He briefly explained the various methods of heating and went into comparisons of costs which, he was able to show, were in favour of electricity if the appliances were properly installed and used. He stressed the ease with which electric heaters could be placed and controlled—by time switch and by thermostat—and the other advantages of electric heaters the value of which could not be so readily assessed. Mr. Berry gave some advice on the choice of type of heater and spoke of his own experience of electric heating.

After his talk Mr. Berry answered a number of questions. Several interrogators queried his cost figures but were assured that they were derived from authoritative sources which Mr. Berry was ready to make available. One or two questioners mentioned the high cost of installation work and the frequent inadequacy of installations.

The second speaker was Flight Lieut. D. E. Kleboe, a young R.A.F. officer, who explained that he was speaking neither for the R.A.F. nor the electrical manufacturers, with whom he had no connection. He had become so appalled at the waste of fuel which he saw everywhere that he had felt impelled to start "writing to the papers" about it and that was how he found himself at the meeting. Mr. Kleboe went on to describe in a convincing manner the electrical installation in a bungalow which he had had built for himself and his family. It was constructed on "all-electric" lines and the saving in building costs had paid for the electrical installation. From records which he had kept and compared with those taken during his previous occupation of a rented house he had proved that it was no dearer and far more satisfactory to employ electrical rather than other methods.

In connection with the conference an exhibition of about sixty electric heating appliances of various types had been arranged for the Press representatives' inspection. Those contributing to the display were H. J. Baldwin & Co., Ltd., Belling & Co., Ltd., Berry's Electric, Ltd., Best Products, Ltd., George Bray & Co., Ltd., British National Electrics, Ltd., Bulpitt & Sons, Ltd., Carron Company, E. K. Cole, Ltd., A. D. Davidson Electric Co., Thomas Dryden & Sons, Ltd., E.M.I. Sales & Service, Ltd., Falkirk Iron Co., Ltd., Falk, Stadelmann & Co., Ltd., Ferranti, Ltd., H. Frost & Co., Ltd., General Electric Co., Ltd., Heatrae, Ltd., Hotpoint Electric Appliance Co., Ltd., Hurseal, Ltd.,

Flight Lieut. Kleboe giving his talk. On his left are Messrs. Claude Simmonds and Raymond Berry

Heatovent Electric, Ltd., Jackson Electric Stove Co., Ltd., Midland Electric Manufacturing Co., Ltd., Mitchell Electric Co., Ltd., Modern Electrical Industries, Ltd., Morphy-Richards, Ltd., Premier Electric Heaters, Ltd., T. Price & Sons (Stampers), Ltd., Remploy, Ltd., Revo Electric Co., Ltd., Simplex Electric Co., Ltd., Sunvic Controls, Ltd., Thermega, Ltd., Unity Heating, Ltd., and Aidas Electric, Ltd.

Trade with Russia

Mr. J. B. Scott (Crompton Parkinson, Ltd.), speaking as chairman at the annual meeting of the Russian Section of the London Chamber of Commerce last week, said that if the rate of expansion were maintained exports and re-exports to Russia this year might reach a total of £60 million of which direct exports would represent £25 million. In spite of "strategic" restrictions there was ample scope for expanding the trade but if controls were removed it would be possible to reach the total of £1,000 million in the next five years suggested in the Bulganin-Krushchev trade offer this year. Mr. Scott said that about 40 per cent of the equipment Russia would like to buy from this country was still under strategic control but he hoped that one day the restrictions would be completely removed.

Aids to Fuel Efficiency

Exhibition of Equipment to be Opened by Minister of Fuel

WHAT is believed to be the largest exhibition of devices for promoting efficient use of fuel held anywhere and the first of its kind in London will be opened at Olympia next Tuesday by the Minister of Fuel and Power (Mr. Aubrey Jones). It will continue until 10th October.

The opportunity is being taken by the Electrical Development Association to display a number of ways in which electricity can contribute to fuel economy. These include a working example of infra-red heating for stoving and enamelling and of rod-type and lamp-type heaters by Metropolitan-Vickers and the General Electric Co. respectively. In the section devoted to instruments and control are an ultrasonic thickness gauge for determining the wall thickness of metal vessels (Dawe Instruments) and an electrical process controller (Evershed & Vignoles). Demonstrations of electrical hardening and quenching in the heat treatment of steel will be given by Electric & Musical Instruments. Thermodare and Nightstor thermal storage heaters, in which the heating elements are embodied in blocks of refractory material, materials used for floor-warming installations, automatic control of industrial illumination by electronic light-sensitive apparatus and electrode boilers are among the other features of the stand.

Heating Devices

The General Electric Co. is showing for the first time 1½ and 3 kW overhead radiant heaters for use where the overall area is exceptionally large. The exhibits also include unit heaters with open-coil spiral elements operating at black heat and air circulation fans. Notable among other space heaters are those in the "Cosyglo" range which distribute the heat evenly within a 120 deg arc of the horizontal plane. Storage water heaters, space heaters of the Nightstor type (1, 1½ and 2¼ kW), and appliances for catering service and for electronic light control are also in evidence.

Among the Evershed & Vignoles exhibits are a simple computer, arranged to demonstrate flow correction for pressure and temperature changes, and a jet-pipe controller system for maintaining, for example, a constant oil-air flow ratio in boiler firing. A control desk and a control cubicle incorporating instruments and other appliances will be on view.

The exhibit of the Cambridge Instrument Co. includes regulating instruments and CO_2 recorders and a working model of a completely automatic controller. Anti-corrosion instruments are also shown. Morgan Refractories, Ltd., concentrate on the Tri-Mor range of castable and plastic mouldable materials suitable for operation (according to grade) at various temperatures up to 2,985 deg F and offering high resistance to slag attack.

Elcontrol confines its display to flame failure and ignitron control, including its application to the combination of oil and pulverised fuel under varying load conditions in large power stations. Nine exhibits are staged by Keith Blackman & Co., mainly in connection with forced and induced draught by fans driven by K.B. electric motors.

A redesigned smoke density indicator incorporating an alarm point on the scale has been introduced by Radiovisor Parent, Ltd., which also displays an automatic anti-hunting device for the photo-electric control of interior lighting. In the latter separate controls are introduced for switching "on" and "off," subject to a delay for a short pre-set period after the light intensity has fallen. This firm's automatic pyrostat provides instantaneous temperature control for repetition heating cycles, e.g. with flash butt-welders.

Two new instruments by Kelvin & Hughes, one recording smoke density and the other a photo-electric cell temperature controller, are being shown for the first time. Glandless solenoid valves, pressure micro-switches of the diaphragm type and thermostats are the chief electrical items shown by Black Automatic Controls. Bennis Combustion has a comprehensive display of boiler equipment. The International Combustion group of companies' exhibit covers a range of steam generating installations by pulverised fuel and oil up to 200 MW, including a large power station exhauster unit. Its associated concern, Riley Products, will show a kiln stoker.

Prominent features of the stand of the John Thompson Group will relate to nuclear power stations. Among them are a scale model of the primary liquid-metal/liquid-metal heat-exchange system of the Atomic Energy Authority's fast reactor station at Dounreay and samples of fabrication in stainless steel of its components. There will also be on view some test plates indicating the welding techniques to be employed in the fabrication of the 1,000 ton steel reactor vessels required in the first C.E.A. commercial nuclear power station, for which A.E.I.-John Thompson Nuclear Energy Co., Ltd., is tendering. Another item with an electrical bearing is to be a partly sectionalised model of a 550 lb/hr "Etaflo" water tube boiler for dual oil-coal burning, as used in Marchwood and other C.E.A. stations.

NEW NUCLEAR ENERGY REACTOR

The United Kingdom Atomic Energy Authority announced a few days ago that "Lido," the latest research reactor at Harwell Atomic Energy Research Establishment, began operating for the first time during Thursday night last week. This reactor is intended primarily for shielding studies, and one of its major tasks is to assist in the development of a British submarine propulsion unit. It is a "swimming pool" type reactor in which the enriched-uranium plate-type fuel elements are suspended in a large concrete tank of purified water. Suspended from a movable trolley is a framework supporting the reactor core which is about the size of a tea-chest. Shielding experiments are made by moving the core of the reactor close to aluminium windows which are set into the walls of the tank. The heat output is about 100 kW.

Atomic Inventions Agreement

An agreement has been made between the United Kingdom, Canadian and United States Governments for the cross-assignment of rights in atomic energy inventions and discoveries to their own and each other's nationals. It is expected that the agreement will be of great advantage to private concerns engaged in the development of the use of atomic energy.

Commercial Motor Show

THIS year's Commercial Motor Show at Earls Court, London, is the largest since the commencement of the series, occupying an area of 275,000 sq ft. The Show, which is organised by the Society of Motor Manufacturers and Traders and is held biennially, closes to-morrow (Saturday).

There are 40 actual vehicle manufacturers exhibiting, including the Sunbeam Trolleybus Co., Ltd., which is displaying a two-axle trolley-bus chassis (type MF2B) suitable for a single- or double-deck body having forward entrance and rear exit. A similar chassis with a 34-seater single-deck body is also shown. This is being supplied to the order of the Colombo Municipal Council and has an overall length of 35ft and a 19ft wheelbase. Another exhibit is the Sunbeam type F4A chassis with a 70-seater double-deck body for the Walsall Transport Department.

A Glasgow type trolley-bus chassis on the stand of British United Traction is shown fitted with traction equipment similar to the 30 sets on order from the General Electric Co., Ltd., for Glasgow Corporation. The equipment consists of a 125 h.p., 550 V motor with overhung auxiliary generator and a butt-contact type master controller arranged for automatic acceleration. Rheostatic braking is provided by the G.E.C. patented "I.R." system which gives protection against over-torque and stabilises the braking effort over a wide range.

Battery Vehicles

The only battery electric road vehicles to be seen are on the stand occupied by Smith's Delivery Vehicles, Ltd. One of these is for the butchery trade and incorporates hygienic fittings of glass, "Formica" and metal finishes. Another, for the bakery trade, is designed to accommodate six tiers of standard bread trays. In compliance with the recent hygienic regulations, both of these vehicles are fitted with "Thermowell" stainless steel washbasin units. Shown for the first time is a Smith's NCB electric 1 ton dairy truck and a 1½ ton heavy duty commuter dairy truck designed especially for the North American market but now also becoming increasingly popular in this country, particularly for bakery deliveries.

The C.A.V. exhibit comprises a representative range of fuel injection equipment and electrical equipment for vehicles. It includes three representative types of generators, sectioned to show the construction, the C.A.V. "G.7," "H.55" and "G.5" of 7, 5½ and 5in diameter respectively, suitable for passenger service and goods vehicles of all sizes. In addition, "D10TBA" (10in) and "D13TB" (13in) trolley-bus generators are exhibited. The former is a motor generator unit with single-shaft construction and the latter an overhung generator for driving from an extension of the traction motor shaft, and designed to give maximum output at low road speeds. A demonstration unit shows the C.A.V. electrically operated public service vehicle door-operating gear in action.

Of special interest is an electrical gear-change control unit, also on the C.A.V. stand. It is designed for controlling the gear-change mechanism of pneumatically operated gear boxes, and consists of an electro-pneumatic valve block situated near the gear box and air compressor and controlled by a selector switch operated by a small gear lever. Clutch or gear-change pedals are unnecessary; gear selection and changing are accomplished simultaneously merely by moving the gear lever, the appropriate gear being engaged by compressed air.

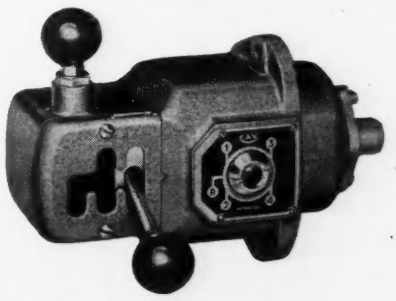
In the accessories section Crompton Parkinson, Ltd., through their associated company, the Young Accumulator Co., Ltd., display a new range of Crompton lightweight batteries. The p.s.v. batteries, to be marketed as from 1st October, are in keeping with the trend to reduce the unladen weight of passenger service vehicles, thereby improving fuel consumption, their weights having been reduced by up to 12 per cent. In addition the marked reduction in weight, coupled with the reduced size, make the batteries much easier to handle, install and maintain.

Other exhibits in this section include samples from the standard ranges of Nife nickel-cadmium batteries and from the recently introduced "DL" high-performance range. Nife Batteries also display for the first time their new special handlamps and cap-lamps approved by the appropriate authorities for use in hydrogen and pentane vapours. On the Chloride Batteries stand are three ranges designed specifically for buses and coaches, "Exide-Ironclad," "Exide series F" and "Exide series H." Those in the "H" range are similar to the series "F" but a greater number of thinner plates is used to give a marked increase in starting performance and a considerable reduction in weight and volume. They are particularly suitable for the lighter-weight buses and coaches now coming into more general use. Main emphasis on the Peto & Radford stand (Holsun Batteries, Ltd.) is placed on the need for reliable starting performance in cold weather. Here the "Dagenite" batteries for public service and commercial vehicles on show have negative plates containing a special paste developed to eliminate winter starting troubles.

The rectifier section of the Westinghouse Brake & Signal Co.'s stand consists of "Westalite" double-voltage battery chargers for battery electrics and industrial and commercial charging, and the range for battery driven delivery vehicles, etc., meets the requirements for all sizes and types of traction batteries.

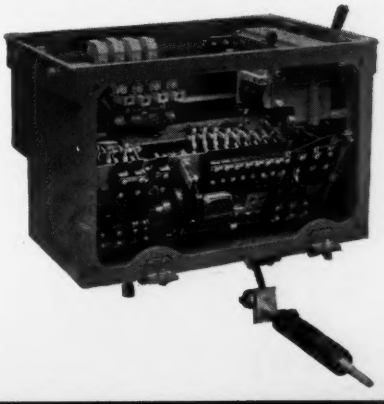
Two new tools in the Black & Decker "Utility" line are shown for the first time, a ¼in de-luxe drill equipped with a geared chuck and a ¾in drill. New portable spot-welding equipment shown by the A.R.O. Machinery Co., Ltd., includes the "D.21" combined heavy-duty contact-breaker and weld-timer with a new patented security control which stops the current supply to the gun in the event of an unreliable earth connection.

The Pye exhibits include a range of mobile and small fixed-station v.h.f. radio-telephone equipment especially suitable for taxis and commercial firms employing lorries, delivery vans, etc., a new range of car radio sets and the recently announced "Transhailer" transistorised megaphone.



C.A.V. electrical gear-change control unit

G.E.C. butt-contact type master controller for trolley-buses



GENERATION AND DEVELOPMENT

Output and Sales in August

In August the rise in electricity output, though less than in July, was again above the average for the year. A total of 5,868 million kWh was generated by the Central Electricity Authority, the North of Scotland Hydro-Electric Board and the South of Scotland Electricity Board compared with 5,307 million kWh in August, 1955, an increase of 10·6 per cent. It will be seen from Table 1 that hydro-electric output was substantially greater than a year ago.

At the end of August the aggregate capacity of plant installed was 23,235 MW, representing an addition of 210 MW during the month.

New plant installed in C.E.A. power stations last month included 60 MW sets at Staythorpe "A" (B.T.H.), Hams Hall "C" (G.E.C.) and Marchwood (English Electric), a 30 MW G.E.C. set at Huncoat and a 180,000 lb/hr John Thompson boiler at East Yelland.

Besides the statistics of electricity generated for public supply, the monthly statement of the Ministry of Fuel and Power records electricity production by the principal industries. For August the figures in million kWh were as follows (August, 1955, figures in parentheses):—Chemicals, 198·6 (196·0); iron and steel, 151·0 (146·0); engineering, 71·5 (65·5); textiles, leather and clothing, 36·8 (41·3); food, drink and tobacco, 14·7 (16·2); paper, 130·5 (135·1); other industries, 23·7 (32·0); total 626·8 (632·1).

The sales of the twelve Area Boards in England and Wales are analysed in Table 2. The national figures show an increase over August, 1955, of 10·7 per cent, but when corrected for weather conditions and working days the increase is 7·3 per cent.

Contract for Supergrid Line

The Central Electricity Authority has recently awarded to Henley's a contract for the Eastern Division covering the supply and erection of 11½ miles of 275 kV double-circuit steel tower overhead line having two 0·4 sq in steel-cored aluminium conductors. The route of this line is East Tilbury to Rayleigh. The contract also covers the supply and erection of 2½ miles of 132 kV double-circuit steel tower overhead line having single 0·4 sq in steel-cored conductors.

Fewer Farms Connected

Mr. H. Evans, chairman of the Merseyside and North Wales Electricity Consultative Council, stated at the last meeting of the Council that the number of additional farms connected by the Board during the previous two months had been considerably lower than in the corresponding period of 1955. The Board still hoped, however, that it would be able to connect at least 1,200 in the present financial year. For the last three years the average annual rate of connection has been 1,270.

Electricity in Merioneth

The Merseyside and North Wales Electricity Consultative Council and Merioneth County Council are to hold a county meeting on 1st November at Dolgelley to discuss electricity in Merioneth. It is hoped that the chairman of the Merseyside and North Wales Electricity Board will be present to explain what the Board has done and is going to do in Merioneth.

Douglas Distribution Scheme

Douglas (I.O.M.) Corporation Electricity Committee has approved a plan submitted by the borough electrical engineer for the laying of three-phase mains in the Strand Street/Castle Street single-phase area, together with a substation and equipment in Villiers Yard, at an estimated cost of £10,200. This installation has become necessary as a result of the demand for electricity for water heating.

Alternative Supply for West Wight

Supply in West Wight will be improved as the result of a proposal by the Southern Electricity Board to spend between £50,000 and £60,000 on a new 33 kV line from Shanklin to Shalfleet.

Overhead Lines Across Tyne

The Central Electricity Authority has erected overhead electricity lines across the Tyne in the vicinity of the Stella North and South power stations. Traffic on the river near the scene of the operations was suspended while the work was carried out.

Plant Extensions in Colombia

The Medellin Power Company, Colombia, is negotiating with the International Bank for a loan for extensions to its Guadalupe plant. The company is arranging with Belgian consultants to investigate the possibilities of a further plant at Rio Nare. The Governor of Norte de Santander is seeking finance for a comprehensive scheme of electrification for his department.

TABLE 1.—ELECTRICITY GENERATED AND PLANT INSTALLED

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total		
Central Electricity Authority ...	2,775	58	28·9	5,346	19	5,371	5,031	21,269
North of Scotland H.E.B. ...	21	—	1·0	32	81	117	115	748
South of Scotland E.B.	181	7	—	338	42	380	361	1,218
Total for August, 1956	2,977	65	29·9	5,716	142	*5,868	5,507	23,235
Corres. total for August, 1955 ...	2,770	60	12·8	5,263	33	5,307	4,967	21,156
Inc. or dec., per cent	+7·5	+8·6	+133·5	+8·6	+332·5	+10·6	+10·9	+9·8
Total to date (8 months), 1956 ...	28,889	626	269·8	55,336	939	56,386	52,966	
Total for corres. 8 months of 1955	26,911	732	149·3	50,562	785	51,456	48,357	
Inc. or dec., per cent	+7·3	−14·5	+80·8	+9·4	+19·7	+9·6	+9·5	

* The total figure includes generation by other methods amounting to 10 million kWh.

TABLE 2.—ELECTRICITY SENT OUT BY AREA BOARDS FOR THEIR CONSUMERS

Area Board	Totals for August (million kWh)			Twelve Months' Totals Ended 31st August (million kWh)		
	1955	1956	Inc. or Dec. %	1955	1956	Inc. or Dec. %
London	376·4	422·0	+12·1	6,324·3	6,892·2	+ 9·0
South Eastern	245·5	294·6	+20·0	3,840·3	4,366·0	+13·7
Southern	303·1	359·1	+18·5	4,643·8	5,230·6	+12·6
South Western	166·7	199·5	+19·7	2,402·6	2,687·8	+11·9
Eastern	398·5	466·3	+17·0	6,216·2	6,922·1	+11·4
East Midlands*	366·6	398·2	+ 8·6	5,456·9	5,923·8	+ 8·6
Midlands*	451·5	469·6	+ 4·0	7,206·2	7,701·3	+ 6·9
South Wales*	296·6	302·9	+ 2·1	4,185·0	4,461·4	+ 6·6
Merseyside and North Wales* ...	311·4	345·2	+10·9	4,261·0	4,681·3	+ 9·9
Yorkshire*	487·2	525·1	+ 7·8	7,067·9	7,701·9	+ 9·0
North Eastern*	291·9	311·6	+ 6·7	4,106·9	4,417·5	+ 7·6
North Western*	546·2	600·4	+ 9·9	7,685·1	8,193·2	+ 6·6
Total all Area Boards	4,241·6	4,694·5	+10·7	63,396·2	69,179·1	+ 9·1
Direct Supplies by Central Authority	164·4	181·9	+10·6	1,748·4	2,101·1	+20·2
Grand Total	4,406·0	4,876·4	+10·7	65,144·6	71,280·2	+ 9·4
Mainly Industrial Areas*	2,751·4	2,953·0	+ 7·3	39,969·0	43,080·4	+ 7·8
Mainly Non-Industrial Areas ...	1,490·2	1,741·5	+16·9	23,427·2	26,098·7	+11·4

* Those in which industrial consumers took over 50 per cent of the total sales in the preceding financial year.

INDUSTRIAL NEWS

Siemens-Ediswan Research Laboratories

The Siemens-Ediswan Research Laboratories were amalgamated on 1st August last. Intended to incorporate the research activities of Siemens Brothers & Co., Ltd., and those of Edison Swan Electric Co., Ltd., the scope of their work will cover the whole field of telecommunications, and aspects of cable research. After considering several sites in the London area it has been decided to erect a group of buildings on a 3½-acre site at Harlow, at the junction of Edinburgh Way and No. 1 Avenue.

The first stage of this building plan, which it is hoped to complete in two years, includes three single-storey laboratories and one three-storey block containing entrance hall, conference room, lecture room, and library, as well as laboratories and offices. This will provide accommodation for a total staff of 100 to 150. Later stages are envisaged in which the three-storey building will be increased to five storeys, the single-storey buildings will be increased to two, and at least three additional structures will be erected.

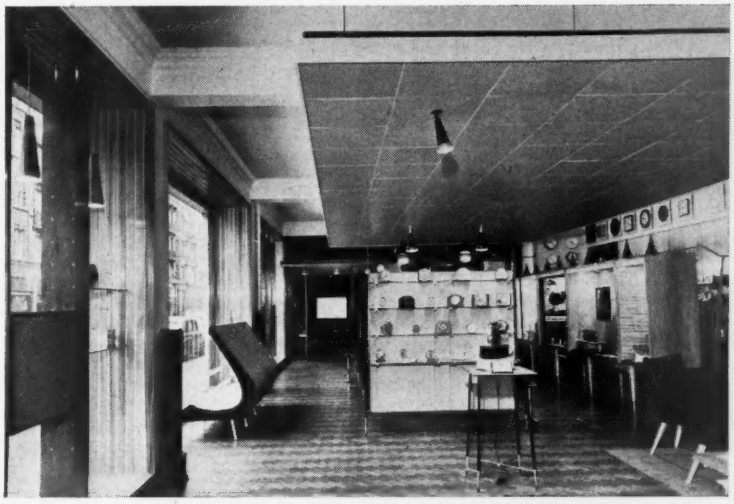
It is not proposed to concentrate the whole of the research staff at Harlow. Sections of the laboratories will continue to operate near the main factories at Woolwich, Sunderland and Lydbrook. Until the Harlow buildings are ready for occupation, laboratory space is being provided at Brimsdown, Woolwich and Blackheath for staff who will ultimately transfer to Harlow. Dr. G. W. Sutton, director of research and education, Siemens Brothers, Woolwich, was appointed director of the Siemens-Ediswan Research Laboratories on 29th March.

Argonarc Welding of Car Bodies

Argonarc spot welding is now being used for the first time in the fabrication of Rolls Royce car bodies by James Young, Ltd., the Bromley coachbuilders. The firm recently introduced a new all-metal body design which offered increased strength and rigidity and an appreciable saving in weight, compared with the former composite wood and aluminium body.

Many of the joints in the new design could only be welded from one side, and the firm decided to employ British Oxygen's Argonarc spot welding process. This is automatic in operation, ensures full fusion from one side only, and is particularly useful for welding joints normally inaccessible to ordinary spot welding equipment. Whereas normal spot welding methods need a comparatively high current to fuse the contact area to welding temperature, the Argonarc torch uses heat from a low current arc struck between a tungsten electrode and the workpiece. The equipment is transportable and the fusing of the top sheet to its bottom counterpart gives a characteristic circular spot weld.

The arc, tungsten electrode and the spot area are protected from the atmosphere by a shroud of argon gas, while the automatic operation is provided by an electric time unit which uses the arc on a wide range—usually from 0·8 to 5 seconds, according to the type and thickness of material. The spot welds on the Rolls Royce body are of even penetration, and the process has enabled the operator to work inside very close tolerances because of the small amount of distortion. Use of the process has enabled production to be speeded up, as one operator can now do the work of two. Gauge thickness on the mild steel body varies from 18 to 20. Gas welding is also being used in one or two places, for strengthening, where the Argonarc spot weld is not used.



Part of the new London display centre of Smiths Clocks & Watches, Ltd.

Clock Display Centre

The new showroom and display centre of Smiths Clocks & Watches, Ltd., opened at 179, Great Portland Street, London, W.1, last week, is claimed to be the most advanced of its kind and provides an outstanding setting for the company's range of horological products. Mr. Hulme Chadwick, A.R.C.A., F.S.I.A., was responsible for the design, and the décor, colouring and placing of the many showcases has been particularly studied to provide a most effective display of clocks, watches, etc. The showroom occupies an area of 1,570 sq ft and the lighting, by John Hearson & Co., Ltd., has been skilfully arranged to give independent illumination to each of the sections and showcases.

In addition to a main front window and its accompanying four large box windows, there are five average sized model windows inside the showroom each with a specimen display of products to indicate to trade visitors the variety and methods of window display.

Iraqi Contract for Brush Group

The Brush Group, Ltd., has signed a contract with the Baghdad electricity authorities to install and have in operation by next May diesel-electric generating equipment for a new peak load power station for the supply of electricity in Baghdad. Mirrlees, Bickerton & Day, Ltd., will supply four Mirrlees KVSS-12 diesel engines each developing from 1,440 to 3,240 b.h.p. at 200 to 450 r.p.m.; and the Brush Electrical Engineering Co., Ltd., is to provide four Brush alternators with a total output of 8,000 kW, besides all the switchgear.

The main building contractors, who are also the Brush agents in Baghdad, are the Autoworks Middle East Car & Transport Co. The Group's engineers will be in charge of the installation of the electrical plant and equipment.

Steel Works Furnaces

In connection with a reconstruction scheme being undertaken by Brymbo Steel Works, Ltd., near Wrexham (a subsidiary company of Guest Keen & Nettlefolds, Ltd.), this steel company has ordered three 40-ton Birlec "Lectromelt" arc furnaces at a cost exceeding £300,000, each having a 16ft shell diameter. The furnaces are to replace the company's existing open hearth plant.

Each furnace will have a transformer capacity of 12,500 kVA, and will be arranged for top charging from buckets of capacity approximately

equal to the available charging space in the furnace when using cold scrap charges. It is, however, intended to use 50 per cent charges of pre-refined hot blast furnace metal in order to reduce the time and cost of melting and to achieve maximum output from these furnaces.

Gas Turbines for United States Navy

The two "G2/2" gas turbines ordered for the United States Navy from the Metropolitan-Vickers Electrical Co., Ltd., have recently been dispatched from the Trafford Park Works. They will be installed as boost propulsion machinery in a U.S. Navy high speed coastal craft and will be operated initially for test and evaluation purposes.

The turbines are generally similar to the company's "G2" type installed in H.M.S. *Bold Pioneer* and H.M.S. *Bold Pathfinder*, now in service with the Royal Navy. It is rated at a maximum output of 4,000 s.h.p. under ambient conditions of 14·7 p.s.i.a. and 26·7 deg C, though under British ambient conditions of 14·7 p.s.i.a. and 15 deg C the maximum power output would be 4,500 s.h.p.

Decorative Lighting

We have received from The Studio, Ltd., 66, Chandos Place, London, W.C.2, a very handsomely produced volume on "Decorative Art" (148 pp., price 35s). It is the 46th edition of the *Studio* year book of furnishing and decoration and it is composed of 500 illustrations (18 in colour) of houses and apartments, rooms and furniture, textiles, ceramics, glass, silverware and lighting. The last-named section contains pictures and brief details of about 40 pendants, wall lights, and table and floor standards of original design exemplifying imaginative treatment of many materials. Some may be considered bizarre but they reflect the widespread modern desire to break loose from the conventional.

Public Works Congress

At the Public Works and Municipal Services Congress, which will be held at Olympia from 12th to 16th November in conjunction with the exhibition of that title, thirty-four papers will be presented. Among those contributing is Mr. N. Axford, manager, Plymouth District, South Western Electricity Board, who will read a paper on "Street Lighting Economics."

Persian Orders for Diesels

The National Gas & Oil Engine Co., Ltd., has obtained contracts to supply diesel engines for two important concerns in Teheran. Two B4A5, 5-cylinder engines, each having a continuous site rating of 750 b.h.p. at 300 r.p.m., driving 450 kW, 380 V, 50 c/s, 3-phase Brush alternators, are to be installed in the Teheran power house of the Silo Administration, and two F4A4 4-cylinder engines, each having a continuous site rating of 380 b.h.p. at 500 r.p.m., driving 220 kW, 380 V, 50 c/s, 3-phase Brush alternators, are to be installed at Isfahan and Tabriz respectively. The Iranian Tobacco Monopoly is to install two B4A6, 6-cylinder engines, each having a continuous site rating of 900 b.h.p. at 300 r.p.m., driving 530 kW, 6,300 V, 3-phase Brush alternators, in its Teheran factory.

Richardsons Westgarth Development

Richardsons Westgarth (Hartlepool), Ltd., announce that they are now manufacturing and marketing economic boilers in a range covering evaporations from 3,000 to 18,000 lb/hr supplied as a complete steam-raising unit with all ancillary equipment or as a bare boiler with steam and water mountings only. Present design follows accepted practice and is in accordance with the latest B.S. specifications relating to construction and materials, special attention being given to ensure the best steaming conditions coupled with general overall efficiency whilst employing a low rating in the region of 6/7 lb/hr sq ft of heating surface. A notable feature which applies to the whole range is that by detail in design it is possible to carry out readily conversion from coal to oil firing or vice versa without modification of the boiler or furnace tubes.

Cable-Making Machine Exports

Continuous lead extrusion machines for sheathing cables, patented and manufactured by Pirelli-General Cable Works, Ltd., have been installed in many parts of the world. During the past year alone they have been exported to Denmark, Belgium, France, Switzerland, Austria and Germany, Canada and Mexico. A machine was recently erected in Japan for the Nippon Cable & Wire Co. (Kanasake). This was the seventh company to take delivery in Japan, where a total of nine machines has been purchased in all.

Johnson, Matthey in France

A new Johnson, Matthey associate company came into existence on 3rd September when the inaugural general meeting of Etablissements Johnson, Matthey et Cie., S.A., took place in Paris. The issued capital is Fr.40 million, of which Johnson, Matthey & Co., Ltd., hold 81½ per cent. The company has been formed to develop Johnson, Matthey sales in France, and has taken over the merchanting business of M. Pierre Motton, who has worked in close collaboration with the London company since 1917. The new company has also absorbed the business of Maurice Carrière et Cie., who acted as correspondents in France for the Bullion Department of Johnson, Matthey. Mr. B. McKenzie has been appointed *président du conseil* and *directeur général* of the French company. M. Maurice Carrière is *directeur général-adjoint*. The other directors are Messrs. Pierre Motton, W. G. Frank and P. G. Smyrk. The offices are at 76, Boulevard Haussmann, Paris.

Lighting Sales Conference

Lighting sales representatives from all parts of the country met at the Cairn Hydro Hotel, Harrogate, for the annual sales conference of Thorn Electrical Industries' Atlas lighting division. Presided over by Mr. J. G. Christopher, general sales manager, the conference lasted from 6th to 9th September and included a tour of the Spennymoor factories where fluorescent fittings and control gear are manufactured. The company's new film "The Better to See" was shown for the first time and the business session concluded with an address by Mr. J. Thorn, chairman and managing director.

Transformer Company's New Premises

New offices were opened recently by Partridge Transformers, Ltd., at Roebuck Road, Tolworth, Surrey. The opening ceremony was performed by Mrs. V. R. Partridge, widow of the founder of the company, and the gathering included Mr. A. L. Bacchus, managing director. The new offices and enlarged factory will permit 50 per cent more production to meet the increasing demand for the company's products, particularly in connection with the electronic control of industry.

Domestic Appliance Sales Competition

A contest for sales men and women throughout the country, with 96 cash prizes offered each month, is being organised during October, November and December by the appliance division of the English Electric Co., Ltd. In this "sell to win" contest, prizes will be awarded on a regional basis, by dividing the country into eight areas, with a first prize of £50, a second prize of £25, and ten third prizes of £5 for each area each month. By the time the contest closes in January, prizes totalling £3,000 will have been awarded. Competitors are asked to list a series of sales points in order of merit and, in 25 words, to suggest ways in which the company could help to promote sales. Prizes will be awarded to those competitors whose list most closely corresponds to the order chosen by the panel of five judges, and whose promotion idea is the most practical. The list of sales points will be varied for each month.

Anyone who sells an English Electric domestic appliance or television receiver in the period 1st October to 31st December has three chances of winning one of 288 cash prizes. Every sale made entitles a competitor to one free enry form valid for the month in which the purchase is made, and there is no limit to the

number of entries a competitor may send in. Entries may be sent in for all three sections of the contest, but competitors will only qualify for one prize in any one month. The closing date for forms to be received in London in each section of the competition will be the 8th day of the following month, i.e. 8th November for the October competition, etc. The judges will be Messrs. W. E. Miller (editor, *Wireless and Electrical Trader*), F. A. Nicholson (managing director, Legget Nicholson & Partners), Owen Pawsey (editor, *Electrical and Radio Trading*), J. I. Hall (public relations officer, English Electric Co.) and H. C. Timewell (manager of the company's appliance and television division).

New British Oxygen Subsidiary

The British Oxygen Co., Ltd., announces that a new private company, to be known as British Oxygen Research & Development, Ltd., has been registered and will come into existence on 1st October. The authorised nominal capital is £1,000. The board of the new company will be Dr. P. H. Sykes (chairman), Dr. N. Booth (managing director) and Dr. L. C. Bannister. The secretary will be Mr. J. W. Coates, and the accountant Mr. H. E. Beyer.

The new company takes over British Oxygen's research and development centre at Morden, Surrey, which has been in operation for over ten years. In addition to its programme of work for British Oxygen, the organisation is being increasingly called on to undertake work for outside bodies, including Government Departments.

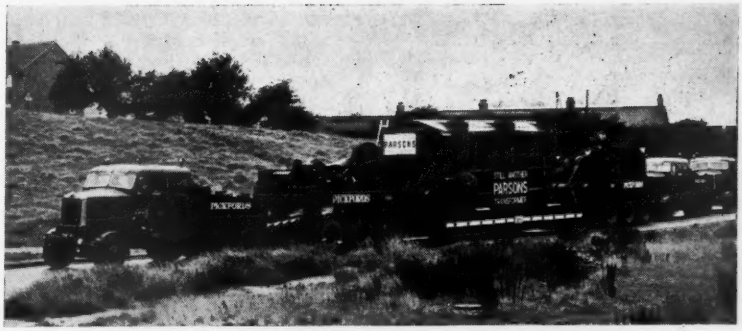
American Turbine Makers' Complaint

Reuter reports from Washington that American turbine manufacturers have asked the United States Government to exclude foreign traders from Federal contracts for hydraulic turbines. The National Electrical Manufacturers' Association said that low production costs had enabled foreign manufacturers to capture export markets formerly served by America. It also stated that the same disparity in costs had enabled foreign manufacturers to submit bids for U.S. Government contracts at levels impossible for American producers to match.

Transformers for Blyth

Two transformers each rated at 120 MVA 275/66 kV are being made by C. A. Parsons & Co., Ltd., for the Central Electricity Authority, North Eastern Division, for connection to the 275 kV supergrid near the new Blyth power station. One of these transformers has passed a comprehensive series of routine and type tests, including both heat runs and impulse tests at 1,050 kV full wave, and has been dispatched from Heaton Works.

The weight of the transformer is 165 tons, thus making it one of the heaviest single loads to be moved by road transport in this country. The weight of the completed transformer on site, including the oil, will be 234 tons. When commissioned, these two transformers will be the largest three-phase units connected to the 275 kV supergrid; each unit has three windings and the equivalent frame rating approaches 150 MVA.



Parsons 120 MVA 275/66 kV transformer en route to Blyth

Monopolies and Restrictive Practices Commission

The Board of Trade announces that it received the Monopolies and Restrictive Practices Commission's Report on the supply of electronic valves and cathode ray tubes on 17th September. It will be published in due course.

Hotpoint Distribution Arrangements

The Hotpoint Electric Appliance Co., Ltd., which is manufacturing the "Princess" washing machine at its Llandudno works, announced the distribution arrangements at a function at Midland Hotel, Manchester, on 20th September.

Mr. D. T. L. Rettie, marketing director, stated that the machine would be sold only in the areas of Merseyside and North Wales and the North Western Electricity Boards for the present. In these areas, 70 per cent of the homes did home washing, compared with 60 per cent in the remainder of the country, and 30 per cent of the homes had some type of electric washing machine, compared with only 15 per cent elsewhere. Mr. Rettie said that Hotpoint would offer the "Princess" washing machine free to anyone for a fortnight's trial in their own home. An extensive advertising scheme, employing Press and television publicity has been prepared. Sales resulting from the free loan offer would go through an electricity service centre or a retailer.

Trade Announcements

Midland Silicones, Ltd., has made arrangements for the additional distribution of silicone electrical insulating compound MS 4 throughout Worcestershire, Warwickshire and South Staffs by Electrical Trades Supply, Ltd., Loveday Street, Birmingham, 4. This agreement marks the completion of arrangements made for the distribution of the compound throughout England and Wales by independent suppliers.

The **Reliance Telephone Co., Ltd.,** asks us to make it clear that its Manchester change of address, announced in our last issue, refers to its Manchester branch office only. The company's head office remains at 43-47, Parker Street, London, W.C.2.

The **Ransome & Marles Bearing Co., Ltd.,** has opened a new branch office at 58-60, Paradise Street, Liverpool, 1 (telephone: Royal 7331), under the managership of Mr. E. L. Paton. The telephone numbers of the company's Leicester office are now 24739 and 24730.

A new service depot will be opened by **Walsall Conduits, Ltd.,** on 1st October at Southend Arterial Road, Gidea Park (near Gallows Corner), Romford, Essex (telephone: Ingrebourne 2783).

Electrical Safeguards, Ltd., are now at 2, Vivian Mansions, Hendon Central, London, N.W.4 (telephone: Hendon 7096). Goods should be sent to 27, West Street, Harrow on the Hill, until further notice.

A new showroom for television, radio and domestic appliances and gramophone records will be opened to-morrow (Saturday) by **Giles (Electrical Engineers), Ltd.,** at 227, Preston Road, Wembley, Middx. The branch will be managed by Mr. A. E. Dee, formerly with Whizards of Baker Street.

The **London Electrical Co. (Blackfriars), Ltd.,** has moved its Gravesend branch to new premises at Shrubbery Road, Gravesend, Kent. The new premises are approximately three times larger than those previously occupied at Swan Yard.

The electric shaver factory of **Remington Rand, Ltd.,** is now at Thornliebank, Glasgow (telephone: Giffnock 6401).

Flexibox, Ltd., has taken over a new Government factory at Ballymena, Northern Ireland, for the production of its mechanical seals. The output from this factory will supplement that of the company's existing works at Trafford Park, Manchester.

Financial Section

STOCKS and SHARES

WHILE developments connected with the Suez Canal have continued to have the main influence upon Stock Exchange conditions, events nearer home have been managing to secure a rather larger share of attention than they did in the early stages of the crisis. In the field of domestic affairs, there was general relief over the discouragement of the idea of an autumn Budget, although the problems created for the Chancellor by the financial strains of the Suez situation continued of course to be seriously appreciated. Among more specific market factors, attention was claimed principally by the interim statement issued by Associated Electrical Industries, covering the first six months of the year, and by the announcement of the capital issues by the General Electric Co. (see page 588).

A.E.I.

The interim report from A.E.I. gives confirmation, in figures, of the general impression that over a wide field industrial earnings are being substantially affected this year by the contraction of profit margins, brought about on the one side by higher wages and other production costs, and on the other by reluctance to raise selling prices correspondingly. Turnover of the A.E.I. group up to June of this year is shown to have been higher than in the same period of 1955 (although below the figure for the second half of that year); but the trading profit, before tax, was down by as much as 20 per cent, and by more than that in comparison with the last June–December period. In receiving this news, the market kept in mind the inadvisability of giving undue importance to only the half of a story, and noted that orders received in the period remained at an impressively high level. The price of the company's £1 shares, however, was marked down during the week from 70s to 65s.

T. C. & M.

Like A.E.I., the Telegraph Construction & Maintenance Company accompanies the interim dividend announcement with a report on earnings during the first half of this year. In this case the six months' figures are given in comparison with those for the full previous year, rather than with the corresponding half of it. They give the group trading surplus to June of this year as £337,000 (against £726,000 for the whole of 1955); and the net profit, after depreciation, research and development charges, as £162,000 (against £390,000 in the previous twelve months) subject to tax. The interim dividend of 3¾ per cent is at the same rate as before, but applies to capital subsequently increased by about a half as a result of the "rights" issue of shares. For last year the total distribution was brought up to 8½ per cent, of which 1 per cent was described as bonus. The price of the company's £1 shares fell a few pence to 27s 6d.

Radio Shares

Radio Rentals 5s shares were marked up from 43s 9d to 47s 6d on the company's announcement that authority

Price Changes in

Company or Board	Nom. Value	Middle price 24th Sept.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1956 Highest	1956 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	73½		3	3	4 1 9	80½	73½
Brit. Elec. 1974/77	100	71½	−1	3	3	4 4 0	79½	71½
Brit. Elec. 1976/79	100	77½		3½	3½	4 10 3	84	77½
Brit. Elec. 1974/79	100	86½		4½	4½	4 18 3	95	87½
Overseas Electric Supply								
Calcutta Elec.	£1	19/3	−3d	6†	6†	6 4 9†	20/9	19/-
East African Power	£1	19/6		7	7	7 3 6	21/3	19/6
Nigerian Elec.	£1	17/6		10	10*	11 8 6	21/-	17/-
Perak Hydro-Elec.	£1	16/-		10	10	—	17/6	14/9
Equipment and Manufacturing								
Aberdare Cables	5/-	12/-xd		17½	17½	7 5 9	13/6	10/6
Aerialite	1/-	4/9		88⅛	45*	9 9 6	6/9	4/9
Allen, W. H.	£1	38/9		20	10*	5 3 3	39/-	33/6
Aron Elec. Ord.	£1	55/9		15	15	5 7 6	56/-	53/6
Assd. Automation	10/-	18/-		10	5	2 15 6	19/-	17/-
Assoc. Elec. Ord.	£1	65/-	−5/-	14	15	4 12 3	85/6	57/9
Automatic Tel. & El.	£1	58/9	+1/3	15	15	5 2 3	72/6	56/3
Babcock & Wilcox	£1	79/6	−6d	15	15	3 15 6	85/6	64/-
Baldwin, H. J.	2/-	5/-		20	20	8 0 0	5/-	3/9
Bakelite	10/-	27/6	+6d	16	16	5 16 6	34/-	26/9
Berry's Electric	5/-	6/-	−3d	—	10‡	8 6 9	6/6	5/9
British Aluminium	£1	71/3	−1/3	12	12	3 7 6	78/9	40/6
B.I. Callender's	£1	49/6	−6d	10	12½	5 1 0	54/3	45/-
B.I. Callender's 6% Pref.	£1	21/9		6	6	5 10 3	22/6	20/3
British Tabulating	£1	50/-	+6d	9	9	3 12 0	51/3	37/3
British Thermostat	5/-	26/3	+1/3	20	25	4 15 3	31/9	24/6
British Vac. Cleaner	5/-	8/-	+9d	30	15*	9 7 6	8/9	6/-
Brook Motors	10/-	33/9		20	25	7 8 3	44/-	31/9
Brush Group	5/-	6/-		10	10	8 6 9	7/9	5/9
Bulgin, A. F.	1/-	4/9		45	50	—	5/3	4/3
Burco Dean	5/-	8/6		—	22½	13 4 9	13/6	8/3
Chloride El. Storage "A"	£1	62/6		17½	17½	5 12 0	73/6	60/9
Clarke Chapman	£1	120/-		20	22½	3 15 0	123/-	89/6
Cole, E. K.	5/-	17/6	+3d	17½	17½	5 0 0	22/3	15/6
Cossor, A. C.	5/-	6/-		15	Nil	Nil	10/3	5/-
Crabtree	10/-	24/6	−6d	20	20	8 3 3	29/3	24/6
Crompton Parkinson Ord.	5/-	13/3		20	16*	6 0 9	15/-	12/3
De La Rue	5/-	16/9		30	30	8 19 0	20/3	15/-
Decca "A"	4/-	26/3		56½	43¾*	6 13 3	44/9	24/9
Desoutter	5/-	31/-		25	30	4 16 9	32/9	25/9
Dewhurst	2/-	6/-		24	30	—	7/6	5/3
Dictograph Tel.	2/-	5/9		20	20	6 19 3	6/9	5/6
Dubilier Condenser	1/-	4/6		25	30	6 13 3	4/9	3/6
Duport	5/-	18/9		23	25‡	6 13 3	21/6	13/9
E.M.I.	10/-	28/-	+6d	10	15	5 7 3	37/-	25/6
Electrical Components	5/-	15/-		25	25	8 6 9	16/-	12/6
Elec. Construction	£1	23/9		8½	8½	7 2 3	29/9	23/9
Elliott Bros.	5/-	32/6		19	17½*	2 13 9	36/9	24/6
Enfield Cable Ord.	£1	14/3	+6d	Nil	Nil	Nil	19/3	13/6
English Electric	£1	47/6	−2/6	12½	12½	5 5 3	66/3	47/3
English Electric 3¾% Pref.	£1	13/-xd		3¾	3¾	5 15 6	14/6	12/6
Ericsson Tel.	5/-	38/-		20†	20†	2 12 9†	42/9	33/6
Ever Ready	5/-	28/3	+9d	35	35	6 4 0	32/9	24/-
Falk Stadelmann	£1	36/9		15	17½	9 10 6	45/9	36/9
G.E.C. Ord.	£1	45/-	−2/6	12½	14	6 4 6	65/6	45/-
G.E.C. 6½% Pref.	£1	22/3		6½	6½	5 16 9	23/9	21/3
General Cables	5/-	12/3		30	30	12 5 0	13/9	11/3
Greenwood & Batley	£1	46/3		17½	17½	7 11 3	47/6	45/-
Hackbridge Holdings	5/-	22/3		25	30	6 14 9	24/6	18/9
Hackbridge & Hewittic	5/-	18/9		30	23*	6 3 0	22/-	17/3
Heatrae	2/-	3/9		15	15	8 0 0	5/1	3/9
Henley's	10/-	16/3	−6d	10½	11½	7 1 6	19/9	14/-
Holophane	5/-	21/3		25	30	7 1 3	21/3	17/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend forecast.

has been given for a share-for-share scrip issue, and that the results for the year ended in August can be expected to reflect another successful year's trading. Shareholders are advised that the issue does not necessarily imply an intention to increase the total dividend distribution. Last year this amounted to a conservative 40 per cent, on which basis the yield on the shares works out at a little under 4¼ per cent. In general, the market in radio shares was helped by the latest monthly figures from the trade, showing a marked improvement in the sale of television sets in August, and ascribing most of the increase to a greater proportion of hire-purchase transactions. The latter are said to account now for more than half the turnover, a ratio not much different from that ruling before last February's new h.p. restrictions were imposed.

Electrical Investments

Company or Board	Nom. Value	Middle price 24th Sept.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield%	1956 Highest	1956 Lowest
Equipment and Manufacturing—continued						£ s d		
Hoover	5/-	23/6		70	50	10 12 9	39/3	23/-
I.C.I.	£1	42/9	−6d	10	10	4 13 6	49/9	41/3
Intl. Combustion	5/-	20/- xd		25	20*	5 0 0	25/-	15/3
Johnson & Phillips	£1	40/9	−6d	15	15	7 7 3	46/6	37/6
Lancashire Dynamo	£1	42/-		15	11*	5 4 9	49/9	40/9
Laurence, Scott	5/-	15/3	−6d	12½	15	4 18 3	16/9	13/3
Lister, R. A.	£1	30/-		9·3	10	6 13 3	35/3	27/6
London Elec. Wire	£1	47/6		12½	12½	5 5 3	52/9	46/5
Lucas, J.	£1	31/9	−9d	7½	7½	4 14 6	40/3	29/6
Marryat & Scott	2/-	10/-		30	30	6 0 0	11/3	9/6
Mather & Platt	£1	55/6		15	15	5 8 0	65/3	51/6
Metal Industries	£1	20/6		9	9	—	27/-	16/3
Midland Elec. Mfg.	£1	45/-		10	12½	5 11 0	48/6	43/6
Morphy-Richards	4/-	21/3	+1/3	35	50	9 8 3	27/3	20/-
Murex	£1	72/6	+1/3	20	20	5 10 3	72/6	60/-
Newman Ind.	2/-	2/3		10	10	8 17 9	2/9	2/1
Oldham & Son	1/-	2/6		20	17½*	7 0 0	3/-	2/3
Parnall (Yate)	5/-	5/6		14	12	10 18 3	9/6	5/6
Parsons, C.A.	£1	88/9xd	−4/6	10	10	2 5 0	97/-	61/6
Plessey	10/-	72/-	+1/9	27½	30†	4 3 3	87/6	56/-
Pye "A" Deferred	5/-	17/-		12½	12½	3 13 6	21/3	14/-
Reyrolle	£1	114/9xd	−2/3	15	16½	2 16 9	117/6	81/-
Rheostatic	4/-	9/9		18½	12†	4 19 0	—	8/3
Richardsons Westgarth	5/-	16/-		16⅔	16⅔	5 4 3	17/-	13/9
Scottish Cables	4/-	15/9		27½	27½	6 19 3	17/9	15/9
Smith (England), S.	4/-	11/-		17½	17½	6 7 3	14/3	10/6
Southern Areas	£1	16/3		10	7½	9 4 6	28/9	15/-
Strand Elec.	5/-	8/-		15	15	9 7 6	8/6	6/9
Sturtevant	5/-	24/3		14·4†	15†	3 1 9†	31/3	22/6
Sun Elec.	£1	33/9		15	20	11 17 0	37/6	35/-
Switchgear & Cowans	5/-	13/6		20	25	9 5 3	17/-	13/6
Taylor Tunnicliff	5/-	11/3	−6d	15	15	6 13 3	14/-	11/3
T.C.C.	10/-	37/6		25	25	6 13 3	45/-	40/6
T.C. & M.	£1	27/6	−6d	8½	8½	6 3 9	34/-	26/-
Telephone Mfg.	5/-	7/-	−6d	10	10*	7 2 9	8/6	6/3
Thorn Elec.	5/-	16/3		15	15	4 12 3	22/6	16/-
Thornycroft	£1	45/-	+1/6	15	15*	6 13 3	49/9	41/3
Tube Investments	£1	57/6	−2/6	22½	14*‡	4 17 6	70/6	54/9
Vactric	5/-	13/6	+1/-	15	17½*	6 9 9	15/-	11/6
Veritys	5/-	8/3		12½	12½	7 11 6	10/-	6/9
Walsall Conduits	4/-	12/6	−3d	70	20*	6 8 0	13/6	10/9
Ward & Goldstone	5/-	39/6		30	35	4 8 6	39/6	29/-
Watford	2/-	6/9	+3d	25	25	7 8 3	7/6	6/-
Westinghouse	£1	72/6		18	18	4 19 3	100/-	71/6
West, Allen	5/-	12/9		15	15	5 17 9	14/6	11/6
Wolf Electric	5/-	17/6		20	20	5 14 3	26/3	17/6
Trusts, Transport and Communications								
Anglo-Portuguese	£1	21/9		8	8	7 7 0	23/6	20/3
British Elec. Traction: Def. Ord. "A"	5/-	18/-		22½	22½	6 5 0	20/-	15/6
Cable & Wireless: Ord.	5/-	10/6	+3d	10	10	4 15 3	11/3	9/6
4% Loan	100	90½		4	4	4 8 6	92½	88
Calcutta Trams	£1	26/3xd		6†	7½†	5 14 3†	27/6	23/-
Cape Elec. Trams	£1	16/3		8	8	9 17 0	20/3	18/-
Marconi Marine	£1	31/-		10	10	6 9 0	34/-	31/-
Oriental Tel. Ord.	1/-	72/6		16	—	—	90/-	67/6
Telephone Rentals	5/-	10/9		12½	12½	5 16 3	11/9	9/9

Telephone and General

The 245,000 ordinary shares of £1 newly issued by Telephone & General Trust at 35s each are now fully paid up and are quoted at about 42s. They rank equally with the old except for participation in the interim dividend of 3 per cent which it is the company's intention to declare next month. In a statement to stockholders at the time of the issue, the company expected that profits this year will be sufficient to maintain the total distribution at 12 per cent, with the final 9 per cent payable on the increased capital. On this basis, the prospective return on the shares is approximately 5¾ per cent.

Price Changes

Leading shares in the electrical engineering market turned easier in sympathy with those of A.E.I. Over the week, C. A. Parsons were down by 4s 6d, Reyrolle by 2s 3d, English Electric and General Electric by half-a-crown each, otherwise price changes were irregular and seldom of any great extent. British Tabulating were again firm, and others showing improvement included Vactric, Watford Electric, Morphy-Richards (this company's results are due early next month), Thornycroft and Automatic Telephone. Lucas were not much affected by news of a limited period of short-time working at some of the factories. Cossors consolidated their recovery to 6s, and Hackbridge Holdings were maintained at 22s 3d after the annual meeting, at which approval was given to the change in the company's name from Hackbridge Cable Holdings.

Diverse Interests

The last accounts of Telephone & General Trust showed that total revenue of £622,000 for the group was derived in roughly equal proportions from dividends, interest, etc., on the one hand and, on the other, from the net profits of the telephone operating companies in whose development the Trust is interested. These include the Anglo-Portuguese Telephone Company and the group operating in the West Indies, all of which are in course of active expansion. In the balance-sheet, the net operating assets of telephone and servicing subsidiaries appeared at a figure of approximately £4·3 million, as compared with a market value of £3·7 million for investments. Net profits of the Trust have been showing steady expansion in recent years. After a long line of 8 per cent ordinary dividends, the rate was raised to 10 per cent for 1954, and by a further 2 per cent this year.

REPORTS and DIVIDENDS

Associated Electrical Industries, Ltd.—The progress report for the six months ended 30th June last shows that while the value of output at £61·2 million rose by £2·6 million, as compared with the corresponding period of 1955, profit margins were down and the trading profit of £5·18 million was lower by £1·32 million. Orders received (mainly for delivery within three years) were valued at £66·9 million. This compares with £73·4 million for January-June, 1955, the figures for which have been revised to bring them on to a comparable basis with the figures for 1956 which now take full account of the activities of overseas companies. For the second half of 1955 the trading profit was £6·83 million, the value of output £69·2 million, and orders received £67·1 million. The first interim ordinary dividend of 2½ per cent was paid in July last. The second dividend of 2½ per cent will be paid on 2nd October. The 8,500,000 ordinary shares issued in March last do not participate in this dividend.

Radio Rentals, Ltd.—The London & Yorkshire Trust has announced that the consent of the Treasury has been received, and the directors of Radio Rentals, Ltd., recommend that the sum of £449,063, part of the amount standing to the credit of share premium account, be applied in paying up in full 1,796,253 ordinary 5s shares to be allotted to ordinary shareholders in the proportion of one new share for every share held. The new shares when issued will rank *pari passu* in all respects with the existing ordinary share and will therefore participate in all dividends thereafter declared on the ordinary shares. Preliminary indications are that the results for the year ended 31st August last will show that the company has enjoyed another successful year, but it is stated that the present proposals do not necessarily imply an intention to recommend an increase in the total amount to be distributed by way of dividend on the increased ordinary capital.

The present authorised capital is insufficient for the proposed issue and the directors recommend that it be increased to £1,500,000 by the creation of an additional 2,000,000 ordinary shares of 5s each. An extraordinary meeting to consider the proposals will be held on 18th October.

The Gas Purification & Chemical Co., Ltd.—This company owns or has a substantial holding in a number of companies covering the production of machine tools, electrical, electronic, radio and television equipment. Its report and accounts for the year ended 31st March last show a trading profit for the year to 31st March last of £516,836, as compared with £338,044 for the preceding 15 months, and after providing £275,270 for taxation and meeting other charges, there is a net balance of £134,061 (against £98,950). The final dividend is 25 per cent, making 40 per cent for the year.

At the annual meeting held on 18th September, Mr. J. R. Sorsbie (chairman and managing director) referred to the progress made by the various subsidiary companies. These include Smart & Brown (Machine Tools), Ltd. (machine tools and electrical equipment); Besson & Robinson, Ltd. (electrical relays and electronic equipment), Modern Machine Tools, Ltd. (machine tools); Pultra, Ltd. (micro lathes and micro grinders); Johnson British Electric, Ltd. (cabinets); Grundig (Great Britain), Ltd. (electrical and electronic equipment); Wolsey Television, Ltd. (radio and television aerials and accessories); Electric Audio Reproducers, Ltd. (sound amplifying and reproducing equipment); Kingsway of London, Ltd. (exporters of high fidelity sound equipment); Staar Electronics, Ltd. (a selling company); and Gas Purification, Ltd. (purification materials for the gas industry). Mr. Sorsbie said that the order books of the members of the group were so full that they were now turning to outside sources of production in addition to their own in order to obtain goods for which they already had orders.

Veritys, Ltd.—An offer has been made by Limit Engineering Group, Ltd., to acquire all the issued capital of Veritys, Ltd., on the basis of four shares of 1s for each 5s stock unit in Veritys. In announcing the offer, the directors of Veritys state that it is at present being considered and a further statement will be issued in due course. Veritys' issued one-class capital is £180,000 on which 12½ per cent has been paid for each of the last three years. Limit Engineering was made public in October last.

The Telegraph Construction & Maintenance Co., Ltd., announces that the group trading profit for the six months ended 30th June last amounts to £337,000, and after providing for depreciation and research and development, the untaxed profit is £162,000. An interim dividend of 3¾ per cent is announced on £2,974,596 capital. A similar interim dividend was declared last year but was paid on capital of £1,954,092.

The Nigerian Electricity Supply Corporation, Ltd.—The annual meeting was held in London on 18th September, Mr. G. Hemmant (chairman) presiding. In his circulated review of the Corporation's activities during the year ended 29th February last, the chairman said that the consumption of electrical power continued to increase with considerably smaller fluctuations than in earlier years. The average annual consumption in the four-year period ended 29th February, 1956, was 60,720,000 kWh, while consumption for the year to 29th February last was 64,160,000 kWh. Various measures to increase the generating capacity of the system of power stations had been under consideration for some time, and last year Balfour, Beatty & Co., Ltd., were asked to report and advise upon further hydro-electric developments of the watersheds in present use, and upon the possible development of watersheds in an additional area approved by the Minister of Lands, Mines and Power in Nigeria. Mr. R. W. A. MacKichan had submitted a report in which he discussed the whole problem. A detailed survey of the Tenti valley and of the Kurra gorge above the Jekko I power station would be necessary to enable their technical advisers to make their final recommendations.

The General Electric Co., Ltd.—It was disclosed earlier this week that the expected capital issue will take the form of £6 million 6 per cent unsecured loan stock, 1976-81, at par, and £4,285,320 £1 ordinary shares. The stock will be offered to present holders of loan, preference and ordinary stocks and the ordinary shares at £2 each to existing holders of ordinary stock in the ratio of three to ten.

W. T. Henley's Telegraph Works Co., Ltd., has announced an interim dividend of 2½ per cent (unchanged).

The Watford Electric & Manufacturing Co., Ltd., is paying an unchanged interim dividend of 5 per cent.

New Companies

Tricity Electric, Ltd.—Registered 13th September. Capital £1,000. Manufacturing, servicing and dealing in electrical and power driven appliances of all kinds, etc. Solicitors: Rowe & Maw, Stafford House, Norfolk Street, W.C.2.

Richards' Domestic Electrics, Ltd.—Registered 31st July. Capital £1,000. Electrical engineers, etc. Directors: S. G. Richards and K. G. H. Richards. Regd. office: 145a, Lewisham Way, S.E.14.

Liquidations

H. L. Prior & Co., Ltd., electricians.—Winding up voluntarily. Liquidator, Mr. J. R. Groom, 6, South Quay, Great Yarmouth, appointed 4th September. Particulars of claims to liquidator by 20th October.

Collier Electric (Switches), Ltd.—In voluntary liquidation. Meetings of members and creditors on 16th October at 199, Piccadilly, London, W.1, to receive an account of the winding-up by the liquidator, Mr. A. C. Blake.

Bankruptcies

S. N. Quinion, trading as Joy & Co., at 9, Charleville Road, West Kensington, London, W.14, as electrical engineers.—Public examination 13th November at Bankruptcy Buildings, Carey Street, London, W.C.2.

P. J. Russell, lately carrying on business at 269, Milton Road, Portsmouth, as a cycle, radio and electrical dealer.—Trustee, Mr. A. A. Walter, Bankruptcy Buildings, Carey Street, London, W.C.2, Official Receiver, released 6th September.

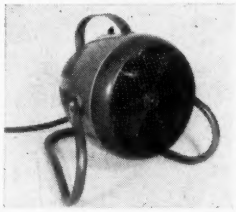
S. Shaw, formerly carrying on business at 109, Leeds Road, Bradford, and now at 133, Leeds Road, Bradford, electrical contractor.—First and final dividend of 1s 9½d in the £, payable on and after 4th October at 8, Eldon Place, Bradford.

NEW ELECTRICAL EQUIPMENT

Fan Heater

A new electric fan heater and air circulator, the "WinSum," has recently been placed on the market by ASHCROFT TOOLS, LTD., Ashcroft Road, Cirencester, Glos.

It is suitable either for use as a free-standing model or for wall mounting purposes, and is claimed to be completely safe for use in a nursery. The black heat element and fan are completely enclosed behind fine wire mesh grilles, and the total consumption is 1,125 W. A hot/cold switch is fitted, and an automatic thermal cut-out as a precaution against the danger of overheating. The finish is in a range of two-tone pastel colour combinations and in addition there is a special model for the kitchen in red and ivory. The overall measurements are 11in by 11in by 10in and the unit is supplied complete with 6ft of 3-core flexible. The price is £4 5s plus £1 18s 3d purchase tax in the United Kingdom.



Ashcroft Tools "WinSum" fan heater

Time-Delay Unit

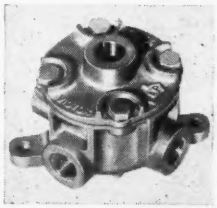
A new self-resetting a.c. time-delay unit mainly intended for switchgear work has been added to the "Rodene" range of timers available from D. ROBINSON & Co., 9, Rectory Field, Harlow, Essex. It can also be used in process-control applications as its action is to operate a change-over switch (rating 5 A) at the end of the timed period, and to hold it in position until the mains are disconnected when the whole unit resets. Repetitive timing can be controlled remotely as it only requires control of the mains to the motor, the dial only having to be turned when a new timed period is needed.

"Rodene" time-delay unit (D. Robinson & Co.)

The timer incorporates a "Rodene 2000" motor which is also supplied separately for driving recorder charts, etc. It is a heavy-duty synchronous unit with a speed of 375 r.p.m. and a built-in gear box giving speeds down to 0·2 r.p.m. The motor also has a built-in automatic clutch which facilitates hand-setting and simplifies the provision of automatic zero reset. The complete time-delay unit occupies about a 4in cube and the price with a time range of 0-1 minute is £7 10s.

Flameproof Junction Box

Suitable for use in completely unprotected and exposed positions as well as for more normal applications is a new weatherproof/flameproof junction box, now being produced by VICTOR PRODUCTS (WALLSEND), LTD., of Wallsend-on-Tyne, Northumberland. Two types are available, a through-way and a four-way. The boxes have a weatherproof joint which is quite separate from the normal flameproof path and are fully Buxton certified for Groups II and III. Metal plugs are available so that unused ways can be completely closed. Back entry or outlet is also provided.



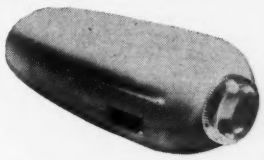
Victor Products weatherproof/flameproof junction box

Internal dimensions are 2·5in by 2in deep; external, 5in over lugs, and fixing centres are 4·3in. Made in malleable iron the boxes have plain covers and conduit entry cover. Entries are ¾in and 1in, electric thread. Larger boxes in aluminium alloy are also available.

Pocket Torch

A new type of pocket torch, the "Accu Lux," has been placed on the market by CHILTON ELECTRIC PRODUCTS, LTD., Hungerford, Berks. Power is derived from two minute batteries of an entirely new design, which are vent free, and thus capable of continuous charge and discharge. The torch also incorporates a charging circuit operable from either 110 or 230 V a.c. Protruding from the base are two pins which fit into a standard 5 A 2-pin socket. These are normally concealed by the end cap, which also houses a spare bulb and rubber sleeve for changing the bulb.

Initially, the "Accu Lux" takes about fifteen hours for a full charge at 230 V and correspondingly longer on reduced voltage. Once fully charged it is claimed to give continuous light for 100 minutes, or intermittent light for 200 minutes. Once it is completely charged, however, it is sufficient to re-charge the torch for approximately eight hours overnight.



Chilton "Accu Lux" pocket torch

It measures less than 5in in length and under 4 oz in weight, and consists of an oval-shaped, cream plastic body, fitted with magnifying lens and bulb, and an on/off switch. A number of accessories are available as optional extras, including an adaptor which enables the torch to be inserted into any electric lamp socket for charging; a ten to one magnifying attachment; a suction device which can be attached to the pins to enable the torch to be fastened to any convenient surface; and red and green lenses. The price is £2 13s 11d plus 11s 1d purchase tax in the United Kingdom.

Magnetic Materials

The range of "Caslox" magnetic materials manufactured by the PLESSEY CO., LTD., Ilford, Essex, for use in television receiver focusing magnets, has been extended by the introduction of a new type known as Grade III. Basically this material, like earlier "Caslox" grades, is a non-metallic magnetic ferrite for use in geometrical configurations where metallic magnets are unsuitable. It has a high stability which results from a high value of coercivity and a permeability only slightly greater than unity.

The new Grade III material has been developed, as an alternative to existing grades, for application where high standards of dimensional accuracy are of greater importance than maximum magnetic properties. This material is low in weight and can be easily machined with carbide-tipped tools. It consists of a powdered magnetic ferrite which is bonded into the shapes desired by the addition of a small quantity of resinous binder. This technique enables tolerances of ±0·005in to be achieved and also permits the moulding in of metallic inserts if required.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 3rd October from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1950

3001. McMichael Radio, Ltd., and Cail, R. A.—Electric vibrator supply systems. 16th January, 1951. (758241.)

1951

29752. Egyesult Izzolampa es Villamos-Sagi R. T.—Cathodes for electric discharge tubes, such as pulse tubes, and a method of making them. 19th December, 1951. (758182.)

1952

17717. British Thomson-Houston Co., Ltd. —Control of electrically-operated winding or like mechanisms. 16th July, 1953. (758344.)

22654. Bendix Aviation Corporation.—Ceramic semi-conductive material. 9th September, 1952. (758437.)

28782. Philco Corporation.—Colour television. 14th November, 1952. (758346.)

32966. Standard Telephones & Cables, Ltd. (Materiel Telephonique Soc. Anon.)—Electric current rectifier system. 30th December, 1952. (758440.)

1953

266. Standard Telephones & Cables, Ltd.—Multi-turn control devices. 5th January, 1953. (758514.)

1133. Electroflo Meters Co., Ltd., and Engel, F. V. A. E.—Measuring and signal transmitting apparatus. 13th April, 1954. (758515.)

7804. Reyrolle & Co., Ltd., A.—Electric busbar systems. 15th March, 1954. (758252.)

8014. Electric & Musical Industries, Ltd. —Electro-magnetic switches. 23rd March, 1954. (758552.)

8917. Metropolitan-Vickers Electrical Co., Ltd.—Electrical overload protective switches. 17th February, 1954. (758192.)

10175. Standard Telephones & Cables, Ltd.—Construction of a fused capacitor unit. 14th April, 1953. (758518.)

13779. Murphy Radio, Ltd.—Servo systems. 17th May, 1954. 758520.)

17046. Philco Corporation. — Electrical apparatus for communication systems. 19th June, 1953. (758357.)

19804. Hunt (Capacitors), Ltd., A. H.—Electrical capacitors. 16th July, 1954. (758254.)

23612. Siemens-Schuckertwerke Akt.-Ges.—Dry rectifiers with liquid cooling arrangements. 26th August, 1953. (758524.)

23927. Electric & Musical Industries, Ltd. —Gain control circuits in television receivers. 30th August, 1954. (758453.)

24155. Kohler, F.—Dielectric heating equipment. 1st September, 1953. (758454.)

24233. Ferranti, Ltd.—Electrical networks. 26th November, 1954. (758525.)

24643. British Dielectric Research, Ltd. —Manufacture of electric capacitors. 7th September, 1954. (Cognate application 4839, 18th February, 1954.) (758197.)

25114. Boin, R., and Boin (née Doms), G. —Electric circuits for discharge lamps. 10th September, 1953. (758455.)

25488. Collins, A. L.—Oscillating and like mechanism for electric fans. 7th September, 1954. (758526.)

26037. General Electric Co., Ltd., and Moore, R. C.—Waveguides and the manufacture thereof. 21st December, 1954. (758457.)

29600. Siemens & Halske Akt.-Ges.—Electrical interlocking control systems for railway signals and points. 26th October, 1953. (758528.)

30219. Thompson & Co. (Sunbury), Ltd., R. E., and Benford, P. R.—Temperature-sensitive safety cut-outs for electric heaters. 25th January, 1955. (758458.)

31085. English Electric Co., Ltd.—Mine winders. 5th November, 1954. (758460.)

32665. Babcock & Wilcox, Ltd., and Bailey Meters & Controls, Ltd.—Methods of and apparatus for controlling the temperature of superheated vapour. 25th November, 1953. (758374.)

32673. Plessey Co., Ltd.—Terminal connections for electrical wiring systems. 22nd November, 1954. (758260.)

35245. Westinghouse Brake & Signal Co., Ltd., and Walker, A. H. B.—Electric control apparatus. 22nd September, 1954. (758537.)

1954

315. Stone & Webster Engineering Corporation.—Steam turbine-generator condensing plants. 5th January, 1954. (758262.)

773. British Thomson-Houston Co., Ltd. —Safety systems for electric supply lines. 29th December, 1954. (Cognate application 20049, 8th July, 1954.) (758208.)

1104. Keith Blackman, Ltd., and Woodley, D. S.—Fan impellers. 12th January, 1955. (758466.)

2158. Philips Electrical Industries, Ltd. —Bucky grid X-ray apparatus. 6th January, 1955. (758540.)

2343. Licentia Patent-Verwaltungs-Ges. —High voltage gas blast electric circuit-breaker. 26th January, 1954. (758266.)

3038. Communications Patents, Ltd.—Wired broadcasting systems. 19th January, 1955. (758542.)

3709. Communications Patents, Ltd.—Radar simulation. 3rd February, 1955. (758210.)

4071. General Electric Co., Ltd.—Electric circuit arrangements for starting and operating electric discharge lamps. 11th February, 1955. (758211.)

5005. General Electric Co., Ltd., and Fairbairn, E. P.—Radio station apparatus. 17th February, 1955. (758546.)

6835. Licentia Patent-Verwaltungs Ges.—Method for measuring magnetic field intensities. 9th March, 1954. (758549.)

7792. Metropolitan-Vickers Electrical Co., Ltd.—Protective systems for electric induction furnace installations. 10th March, 1955. (758551.)

9103. Babcock & Wilcox, Ltd.—Tubulous vapour generating and vapour heating units and an improved method of generating and superheating vapour. 29th March, 1954. (758554.)

9714. International Business Machines Corporation.—Clock synchronising or correcting means controlled by radio time signals or the like. 2nd April, 1954. (758393.)

10465. Ellenberger & Poensgen Ges.—Multi-pole circuit-breaker more particularly for electric motors. 9th April, 1954. (758558.)

10511. Svenska Aktiebolaget Gas-Accumulator.—Electric arc welding or soldering of pins, studs or the like. 9th April, 1954. (758473.)

14585. Hotpoint Electric Appliance Co., Ltd.—Electric water heaters. 18th May, 1955. (758218.)

16982. Illinois Testing Laboratories, Inc. —Circuit control apparatus. 9th June, 1954. (758221.)

17342. Automatic Telephone & Electric Co., Ltd.—Electro-magnetic relay circuits. 25th May, 1955. (758405.)

17388. Erie Resistor Corporation.—Barium titanate dielectric. 14th June, 1954. (758145.)

17586. Klemp, G.—Electric heating stoves. 15th June, 1954. (758576.)

18511. Academy Electrical Products Corporation.—Electrical connectors of the insulation piercing type. 24th June, 1954. (758288.)

18566. Brush Electrical Engineering Co., Ltd.—Voltage regulating arrangements for alternators. 6th January, 1955. (758578.)

19481. Veeder-Root, Inc.—Electric timer switch. 2nd July, 1954. (758148.)

19850. Standard Telephones & Cables, Ltd.—Radio transmitting installations. 7th July, 1954. (758408.)

20152. Standard Telephones & Cables, Ltd.—Amplitude modulated radio transmitters. 9th July, 1954. (758294.)

21199. Philips Electrical Industries, Ltd. —Devices for X-ray examination comprising an image intensifier and a kinematographic recording camera. 20th July, 1954. (758581.)

22011. Sensi, A.—Electrical terminations. 28th July, 1954. (758159.)

22965. General Electric Co.—Electrolytic fluorination of chlorohydrocarbons. 6th August, 1954. (758492.)

23839. Udylite Research Corporation.—Electrodeposition of nickel. 16th August, 1954. (758162.)

24068. Telefunken Ges.—Electric coils and transformers. 18th August, 1954. (758583.)

25242. International Business Machines Corporation.—Electric information storage system. 31st August, 1954. (758495.)

25322. Siemens-Schuckertwerke Akt.-Ges.—Steam turbines. 31st August, 1954. (758166.)

25355. Taylor, Tunnicliff & Co., Ltd.—Electric insulators. 1st September, 1955. (758298.)

25829. Union Carbide & Carbon Corporation.—Metal arc welding. 6th September, 1954. (758300.)

26069. Telemecanique Electrique. — Devices for making electrical connections. 8th September, 1954. (758301.)

26262. Marconi's Wireless Telegraph Co., Ltd.—Radar systems. 6th July, 1955. (758169.)

27900. Donnelly, T. S. — Electrode holder. 27th September, 1954. (758233.)

27935. Babcock & Wilcox, Ltd.—Combustion apparatus. 28th September, 1954. (758171.)

29055. Minneapolis-Honeywell Regulator Co.—Electron discharge device. 8th October, 1954. (758234.)

30817. Allmanna Svenska Elektriska Aktiebolaget.—Exposure meter for electron microscopes. 26th October, 1954. (758240.)

33323. General Electric Co.—Gas blast electric circuit interrupters. 17th November, 1954. (758505.)

33442. MacLean, W. D.—Elecro-plating apparatus. 18th November, 1954. (758430.)

34697. Compagnie Générale de Télégraphie sans Fil.—Non-metallic magnetic material and its process of manufacture. 30th November, 1954. (758320.)

35984. Marie, G. R. P.—Dielectric antenna with dielectric feed means. 13th December, 1954. (758327.)

37286. Erren, R. A.—Wind-power installation. 23rd December, 1954. (758628.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 5th October:—

FLUXBOND. No. 752,697. Class 9. Insulated electric wire.—Scott Insulated Wire Co., Ltd., Queensland Works, Westmoreland Road, London, N.W.9.

ROB ROY NU-FLOW. No. 753,108. Class 9. Electric flat irons.—Philip Woolfson, Ltd., trading also as Scottish Precision Engineering Co., 27 and 33, Cadogan Street, Glasgow, C.2.

JOYVAC. No. 754,889. Class 9. Vacuum cleaning apparatus (electric).—British Vacuum Cleaner & Engineering Co., Ltd., Goblin Works, Ermyn Way, Leatherhead, Surrey.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Raom 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

Monday, 1st October

BIRMINGHAM.—Grand Hotel. I.E.E. South Midland Centre. Annual general meeting, chairman's address, by C. J. O. Garrard and conversazione.

HULL.—Y.E.B., Ferensway, 7 p.m. I.E.S. Leeds Centre. "Home Lighting," by Jean L. Stewart.

ILFORD.—Angel Hotel, 7.30 p.m. A.S.E.E. North East London Branch. Film show.

LEEDS.—Great Northern Hotel, 7.30 p.m. A.S.E.E. Leeds Branch. "Local and Decorative Lighting," by L. A. Fickling.

LIVERPOOL.—At the Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey & North Wales Centre. Chairman's address, "Review of Progress of Electricity Distribution," by P. d'E. Stowell.

LONDON.—Burlington House, W., 5.30 p.m. Society of Engineers. "The Calder Hall Nuclear Power Station," by K. J. Frost.

Caxton Hall, S.W.1, 7 p.m. E.P.E.A. London Technical Group. "Corrosion in Steam Powered Electrical Generating Plant," by J. B. Cotton.

NEWCASTLE-UPON-TYNE. — County Hall, Neville Street, 6 for 6.30 p.m. North East Electrical Club. Annual meeting and presidential address by T. M. Ayres.

READING.—Small Town Hall, 7.30 p.m. I.E.E. district meeting. "Insulating Oils for the Electrical Industry," by C. F. McCue.

SHEFFIELD.—Royal Victoria Station Hotel, 7.30 p.m. A.S.E.E. Sheffield Branch. "Beam Engines, and other Railway Antiquities," by G. F. Jones.

Tuesday, 2nd October

CARDIFF.—Angel Hotel, Westgate Street, 7.30 p.m. A.S.E.E. South Wales Branch. A.S.E.E. Exhibition film, followed by talk by E. A. Bromfield and informal discussion.

EDINBURGH.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South-East Scotland Sub-Centre. Centre chairman's address, by Prof. F. M. Bruce.

25, Charlotte Square, 7 p.m. Incorporated Plant Engineers, Edinburgh Branch. "Incentives for Maintenance."

HAMMERSMITH.—Windsor Castle Hotel, 134, King Street, 7.30 p.m. A.S.E.E. West London Branch. "Recent Developments in Resistance Welding Applications," by C. A. Burton.

HARRINGAY.—"Queen's Head," 677, Green Lanes, 7.45 p.m. A.S.E.E. North London Branch. "Temperature Indication and Control," by C. Dupen.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Centre. Chairman's address, by W. K. Fleming.

LOUGHBOROUGH.—The College, 6.30 p.m. I.E.E. East Midland Centre. Informal conversazione and reunion.

MANCHESTER. — Engineers' Club, Albert Square, 6.30 p.m. I.E.E. North-Western Centre. Chairman's address, by T. E. Daniel.

NEWCASTLE-UPON-TYNE. — Crown Hotel, 7.30 p.m. A.S.E.E. Tyneside Branch. "Fluorescent Lighting."

READING.—Palmer Hall, West Street, 7.15 p.m. A.S.E.E. Oxford, Reading and Districts Branch. "Radio Frequency Heating," by B. Kellett.

RUGBY.—College of Technology & Arts, 6.30 p.m. I.E.E. Rugby Graduate & Student Section. Chairman's address, "Applications of Radar," by A. R. Petheram.

Tuesday, 2nd October, to Wednesday, 10th October

LONDON. — Olympia. National Fuel Efficiency Exhibition.

Wednesday, 3rd October

EDINBURGH. — Y.M.C.A., 14, South St. Andrew Street, 6.15 p.m. I.E.S. Edinburgh Centre. "Light Sources for Colour Matching," by E. E. Miles and D. C. Peach.

GLASGOW.—39, Elmbank Crescent, 7 p.m. I.E.E. South-West Scotland Sub-Centre. Centre chairman's address, by Prof. F. M. Bruce.

39, Elmbank Crescent, 7.30 p.m. Institute of Metal Finishing, Scottish Branch. Chairman's address, by W. Watson.

39, Elmbank Crescent, 8 p.m. A.S.E.E. Glasgow Branch. "Switchgear."

LEICESTER.—College of Art & Technology, 6.30 p.m. Incorporated Plant Engineers, Leicester Branch. "Power Transmission."

LONDON.—2, Savoy Hill, W.C.2, 2.30 p.m. Electrical Association for Women, London Branch. "Lighting for Living," by E. B. Sawyer.

MANCHESTER.—Engineers' Club, Albert Square, 7.30 p.m. A.S.E.E. Manchester Branch. Debate on automation.

NEWCASTLE-UPON-TYNE. — King's College, College Road, 6.15 p.m. I.E.S. Newcastle Centre. Chairman's address, by P. S. J. Underwood.

PORTSMOUTH.—111, High Street, 6.30 p.m. I.E.E. Southern Centre. Chairman's address, by H. Robson.

PRESTON.—R.A.F.A. Club, East View, 7.30 p.m. A.S.E.E. Preston Branch. "Water for the Extinguishing of Oil Fires in Electricity Stations," by H. Hoyle.

SWANSEA.—S. Wales Electricity Board, The Kingsway, 6.30 p.m. I.E.S. Swansea Group. Chairman's address, by G. J. Higgs.

Wednesday, 3rd October, to Friday, 5th October

SOUTHPORT.—Cambridge Hall, Lord Street. National Smoke Abatement Society. Annual conference.

Thursday, 4th October

BANBURY.—Crown Hotel, 6.30 p.m. I.E.E. Rugby Sub-Centre. "Instrumentation in the Iron and Steel Industry," by S. S. Carlisle.

CHELMSFORD. — Hoffmann's Social Hall, 7.30 p.m. Chelmsford Engineering Society. Presidential address, by W. H. Swayne.

CROYDON.—Half Moon Hotel, Broad Green, 8 p.m. A.S.E.E. South London Branch. "Electrical Safety," by S. J. Emerson.

GLASGOW.—39, Elmbank Crescent, 6.30 p.m. I.E.S. Glasgow Centre. "Light Sources for Colour Matching," by E. E. Miles and D. C. Peach.

LONDON.—Savoy Place, 5.30 p.m. Institution of Electrical Engineers. Inaugural address as President, by Sir Gordon Radley.

Management House, 8, Hill Street, 2.30 p.m. British Institute of Management. Address by Dr. H. H. Race (American General Electric Co.).

MANCHESTER. — College of Technology, Sackville Street, 6.30 p.m. British Institution of Radio Engineers, North Western Section. "Education for Electronics," by R. H. Garner.

NOTTINGHAM.—Electricity Service Centre, Smithy Row, 5.30 for 6 p.m. I.E.S. Nottingham Centre. Chairman's induction, followed by films.

PETERBOROUGH.—White Lion Hotel, Church Street, 7.30 p.m. Incorporated Plant Engineers, Peterborough Branch. "Design of Condensing and Feed Heating Plant," by J. Denton.

Friday, 5th October

CHELTENHAM. — North Gloucestershire Technical College, 7 p.m. British Institution of Radio Engineers, South Midlands Section. "Television Lighting Effects," by A. E. Robertson.

FAWLEY.—Copthorne House, 7 p.m. Society of Instrument Technology, Fawley Section. "Electrically Operated Process Control Equipment," by R. J. Redding.

LIVERPOOL.—9, The Temple, 24, Dale Street, 7.30 p.m. A.S.E.E. Liverpool Branch. "The Modern Police Force," by Chief Inspector Collins.

LONDON.—Park Lane Hotel. Electrical Trades' Commercial Travellers' Association. Ladies' night.

Dorchester Hotel, W. Institution of Production Engineers. Annual dinner.

NEWCASTLE-UPON-TYNE. — Kings College, 6.30 p.m. I.E.E. North Eastern Graduate & Student Section. Chairman's address, "Copper from the Raw Material," by N. Young.

STAFFORD.—Technical College, 6.30 p.m. I.E.E. North Staffordshire Sub-Centre. "A talk on a Tour of the U.S.S.R. by a Delegate from the C.E.A.," by R. L. Batley.

Saturday, 6th October

LONDON.—Fuller's Restaurant, 206, Regent Street, 6 p.m. London Association of Engineers. "Atomic Energy and the Engineer," by W. R. Wootton, followed by film.

Trolley-bus Operation

The 1955-56 report of the general manager of the Wolverhampton Municipal Transport Department (Mr. R. H. Addlesee, M.Inst.T., M.I.T.A.) shows that the trolley-buses earned a revenue of £734,799, equal to 31·190d per vehicle-mile, as compared with £722,043 and 30·541d per vehicle-mile in 1954-55. Working expenses amounted to £637,952 (£582,071), or 27·079d (24·620d) per vehicle-mile. The total mileage run was 5,654,047 (5,674,055). Against the gross surplus of £96,848 from the trolley-buses there was a loss of £35,794 on the motor-buses, reducing the overall gross profit to £61,054, and after meeting loan charges there was a net deficiency of £67,352. This compares with a deficiency of £2,821 in 1954-55 when there was a gross surplus of £139,972 on the trolley-buses and a loss of £6,013 on the motor-buses.

Reporting on the results of the Sheffield Corporation Transport Department for the past year, the general manager (Mr. R. C. Moore, M.Inst.T.) shows that traffic revenue in 1955-56 improved by £401,987 to £3,770,792, mainly due to fare increases and to some extent to the fine summer of 1955. Revenue from the tramways rose from £1,321,081 to £1,471,901. The gross surplus on both tramways and motor-buses was £630,468 (against £376,889) and after meeting debt charges and appropriations there was a net surplus of £24,149 (£9,219). The tramway mileage operated during the year was 8,854,521 against 9,556,344 in 1954-55 and the motor-bus mileage 15,848,884 against 15,954,193. The tramways revenue was equal to 40·169d per vehicle-mile (33·369d in 1954-55) and working expenses were 35·392d (32·609d).

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—5th February. Snowy Mountains Hydro-Electric Authority. Four 70 MW generators. (E.S.B. 23579/56. Ten/21493.)* Four 96,000 b.h.p. water turbines. (E.S.B. 23578/56. Ten/21494.)*

20th November. General Post Office. Instruments. (E.S.B. 23986/56. Ten/21584.)*

Ayr.—6th October. Burgh Council. Street lighting equipment. (See this issue.)

British East Africa.—10th October. Kampala Municipal Council. 100 street lighting columns. (E.S.B. 23897/56. Ten/21546.)*

Burma.—8th October. Union Purchase Board. 200 car batteries. (E.S.B. 22786/56. Ten/21463.)* 10th October. Electric fittings including fuse boards, knife switches, fuses, fuse holders, etc. (E.S.B. 23244/56. Ten/21486.)* Telephone transmitter and receiver units. (E.S.B. 23246/56. Ten/21479.)* 17th October. 254 voltmeters. (E.S.B. 23434/56. Ten/21447.)*

Canada.—31st October. Saskatchewan Power Corporation. Overhead transmission equipment and transformers. (E.S.B. 22826/56. Ten/21508.)*

Denbighshire.—3rd October. County Council. Electrical installation in the secondary modern school at Rossett, near Wrexham. (See this issue.)

Derby.—10th October. Town Council. Electrical installations in 124 houses on the Sunny Hill estate. Borough architect, Council House, Corporation Street.

Durham.—12th October. County Council. Electrical equipment for Windlestone Hall Residential School. G. H. Metcalfe, director of education, Shire Hall, Durham.

Edinburgh.—North of Scotland Hydro-Electric Board. 33 kV overhead lines and submarine cables. (See this issue.)

Ellesmere Port.—15th October. Borough Council. Street lighting equipment. (See this issue.)

Fylde.—17th October. R.D.C. Street lighting equipment. Surveyor, 29a, Station Road, Kirkham, Lancs.

Horsham.—19th October. U.D.C. Street lighting equipment. (See this issue.)

India.—9th October. Director General of Supplies and Disposals. Five electric passenger lifts. (E.S.B. 23939/56. Ten/21565.)*

19th October. Government of Uttar Pradesh, Electricity Department. L.v. circuit-breakers. (E.S.B. 23279/56. Ten/21500.)* 31st October. Power transformers. (E.S.B. 23278/56. Ten/21499.)*

15th October. Store Purchase Committee, Mysore. Twenty 66 kV air-break disconnecting switches. (E.S.B. 23499/56. Ten/21540.)*

19th October. India Supply Mission, Washington. Electronic instruments for laboratory use. (E.S.B. 24044/56. I.C.A. Ten/21550.)*

12th October. Madhya Pradesh Electricity Board, Nagpur. Transformers for auxiliary service at Korba thermal power station. (E.S.B. 23747/56. Ten/21577.)* 24th October. 11/33/132 kV transformers for Korba. (E.S.B. 23748/56. Ten/21578.)* 7th November. 33/132 kV switchgear and accessories. (E.S.B. 23745/56. Ten/21525.)* 12th November. Coal handling plant for Korba. (E.S.B. 23746/56. Ten/21527.)*

Luton.—10th October. Borough Council. Electrical installation in New Bedford Road County Secondary Technical School. (See this issue.)

Manchester.—6th October. County Council. Street lighting equipment for one year to 31st December, 1957. City surveyor, Town Hall.

Northern Ireland.—10th October. Electrical installation in the Castewellan Intermediate School, County Down. Varming & Mulcahy, 37, Malone Road, Belfast.

Pakistan.—6th October. Posts and Telegraphs Department. Underground cables. (E.S.B. 23667/56. Ten/21518.)*

Portuguese East Africa.—19th October. Ports, Railways and Transport Department, Lourenço Marques. Electrical materials including outdoor lighting assemblies, conductors, switchboards, etc. (E.S.B 23707/56. Ten/21557.)*

Portuguese West Africa.—31st October. Luanda Light and Water Services. 6·6 kV distributing station. (E.S.B. 23261/56. Ten/21492.)*

Rhodesia and Nyasaland.—16th October. Salisbury Corporation. Polythene cable. (E.S.B. 23753/56. Ten/21521.)*

South Africa.—11th October. Union Tender and Supplies Board. Copper and bronze sleeves. (E.S.B. 23359/56. Ten/21490.)*

19th October. Stores Department, South African Railways. Electrical cable. (E.S.B. 24016/56. Ten/21559.)*

26th October. City of Durban Corporation. Two 15 MVA transformers. (E.S.B. 23586/56. Ten/21535.)*

Southern Rhodesia.—1st November. Electricity Supply Commission, Salisbury. Three 3 MVA transformers and spares. (E.S.B. 23206/56. Ten/21459.)*

Spain.—30th October. Iberduero, S.A., Delegación en Madrid. 50,000 kVA synchronised compensator. (E.S.B. 23532/56. I.C.A. Ten/21484.)*

Thurso.—5th October. Burgh Council. Street lighting equipment. (See this issue.)

United States.—18th October. U.S. Corps of Engineers, Little Rock, Arkansas. 480 V station service switchgear assembly. (E.S.B. 23627/56. Ten/21554.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Barnstaple.—Houses (40) (contract A) at West Sowden and Forches estates and old people's bungalows (11) (contract B) at West Sowden. Borough surveyor, The Castle.

Bath.—Domestic science training college for E.C.; Hugh D. Roberts, architect, 30, Brock Street.

Bentley-with-Arksey.—Houses (136), Eskdale Drive, Lowgate and Stonehill Rise; old people's bungalows (44), Petersgate and Amersall Road; R. Penlington, U.D.C. surveyor, Cooke Street, Bentley, near Doncaster.

Birmingham.—Eight-storey block of flats at Melville Road, Edgbaston (£417,000), for Housing Committee; W. J. Simms, Son and Cooke, Ltd., builders, Haydn Road, Sherwood, Nottingham.

Bristol.—Five-storey offices in Quay Street; Laurence M. Gotch & Partners, architects, 8, City Road, London, E.C.1.

Chepstow.—Mill at Sudbrooke for Wiggins, Teape & Co., Ltd.; Turriff Construction Co., Ltd., Budbrooke Road, Warwick.

Chippenham.—Houses (100), Bristol Road site; borough surveyor, The Old Palace, Market Place.

Crook (Co. Durham).—Houses (100), Willington and Crook; Page, Son & Hill, architects, 75, King Street, South Shields.

Croydon.—Office block, Woodside Green; Palmer's Travelling Cradle & Scaffold Co., Ltd., 129, Great Suffolk Street, London, S.E.1.

Darlington.—Church in Welbeck Avenue; Dunn & Dunwell, Ltd., builders, Arden Street, Darlington.

Doncaster.—Second stage of technical college scheme (£340,000); borough architect, 15, South Parade.

Glasgow.—Houses (582), Blairardie and Yoker, for Housing Committee; John Lawrence (Glasgow), Ltd., contractors, 137, West Regent Street.

Great Yarmouth.—Reconstruction of central library; borough engineer.

Greenford.—Laboratory; Taylor Woodrow, Ltd., Ruislip Road.

Hounslow.—Flats (94), Lampton Road; Bell Houses, Ltd., Golden Court, Richmond.

Jarrow.—R.C. church, York Avenue (£21,000); A. E. Gunning, architect, 18, Eldon Square, Newcastle-on-Tyne.

London.—Showrooms and offices, Old Bond Street, Mayfair; Ford & Walton, Ltd., Walton House, Warton Road, E.15.

Flats and maisonnettes (104), Golborne Gardens, North Kensington; Sir Wm. Holford & Partners, 2a, Angel Court, E.C.2.

Office block, Vauxhall Bridge Road, Westminster; Wm. Moss & Sons, Ltd., North Circular Road, N.W.2.

Manchester.—Factory, Mosley Road and Westinghouse Road; British Oxygen Gases, Ltd., Bridgwater House, Cleveland Row, London, S.W.1.

Newcastle-on-Tyne.—Conversion of Carlton House into College of Commerce for the E.C. (£22,000); J. T. Douglass, builder, Benton, Newcastle.

Houses (79), Kenton North; Thomas Armstrong, Ltd., builders, Robson Street.

North Riding.—Proposed Wensleydale County Modern School (£186,000); C. Chapleo & Son, builders, Leyburn, Yorkshire.

Northern Ireland.—Secondary intermediate school for girls, Marymount, Lurgan; W. H. McEvoy, 73, May Street, Belfast.

Offices, Victoria Street and High Street, Belfast; Amalgamated Transport & General Workers Union, 66, Victoria Street.

Factory at Castlereagh for Mission Manufacturing Co., Ltd., of U.S.A.; J. McCreedy, Ltd., Montgomery Road, Cregagh, Belfast.

Scarborough.—Showrooms and offices, Falconers Road, for Saville & Ezard, Ltd.; Wilkinson, Smith & Brittlebank, architects, Martins Bank Chambers.

Sunderland.—Offices, etc., Silksworth Road, for the British Transport Commission; E. J. Holmes, architect, 31a, York Place, Leeds.

Houses (148), Hylton Red House estate; L. W. Evans, Ltd., contractors, 18, Norfolk Street.

Welwyn Garden City.—Eight-storey hospital proposed for the North West Metropolitan Regional Hospital Board; regional architect, Sheffield House, Sheffield Street, London, W.C.2.

Wigton.—Houses (50), Noble Croft estate; R.D.C. surveyor.

Wingerworth (Chesterfield). — Research centre, including offices, laboratories, etc., for British Coke Research Association, 74, Grosvenor Street, London, W.1; Westwood, Sons & Harrison, architects, 46, Baker Street, London, W.1.

Wortley.—Houses (52), Pilley, near Barnsley; Arthur Wikeley, R.D.C. surveyor, Council Offices, Grenoside, Sheffield.